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1984

EDITORS

K. A. MILLS

J. L. BATES

Honourable Joel R. Matheson, Q.C., Minister

John J. Laffin, P. Eng., FEIC, Deputy Minister

Halifax, Nova Scotia

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Typing - R. Jones
L. Miller

Drafting - D. Bernasconi
G. MacDonald
P. Belliveau
J. Campbell
W. Burt
C. Phillips

Photography - R. Morrison
C. Murphy

FOREWORD

It is a pleasure for me to provide introductory remarks for the 1984 Report of Activities.

This particular Departmental publication concentrates primarily on activities generated in the first year of the Canada - Nova Scotia Mineral Development Agreement.

The bulk of this activity falls within the responsibility of the Mines and Minerals Branch. However, necessary research overlap and coordination has lead to the inclusion of important onshore research conducted by the Energy Resources Division of this Department's Energy Branch.

Similarly, other papers within this Report document ongoing cooperative investigations involving the staff of this Department and university geology departments.

I note, with interest, a number of topics which specifically address Nova Scotia environments for coal, peat, tin, antimony, celestite and gold. These commodities are currently undergoing serious development investigations by the private sector.

I trust that the information contained in this annual publication will serve as a stimulus for the above and other mineral-related activities.

Joel R. Matheson

Joel R. Matheson, Q.C.
Minister of Mines and Energy

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EVALUATION OF THE NO. 3 CROWN PILLAR, SPRINGHILL, NOVA SCOTIA

R. Naylor and S. Chesal

The potential for profitable surface mining of coal reserves remaining in crown pillars has been the focus of a recent study by the Coal Section of the Nova Scotia Department of Mines and Energy. Crown pillars are here defined as blocks of coal left between underground workings and the surface. To date the study has concentrated on the No. 3 seam in the crown pillar of the No. 3 mine in Springhill. The location of the portion of the No. 3 crown pillar examined in relation to the outcrop of coal seams in the Springhill coalfield is illustrated in Figure 1. To delineate the quality and remaining reserves of the No. 3 crown pillar included in the study area, a series of eight lines were drilled. The purpose of these lines were:

1. to determine the width (parallel to dip) of the pillar;
2. to locate the old workings adjacent to the pillar;
3. to determine the strike length;
4. to determine the depth of overburden; and
5. to obtain coal quality information.

A total of seven intersections of the No. 3 seam were sampled and proximate analyses were provided by CANMET Laboratories, Sydney.

Following completion of the drill program the study area was divided into two zones (A and B). Each zone was evaluated independently to determine the coal quality and reserves. In determining the coal quality and volume of coal within zones A and B, four cases were examined.

Case 1 - includes the total volume of coal in the crown pillar extending from the subcrop to the limit of abandoned workings.

Case 2 - the feather-edge coal is excluded from the total volume calculation of the reserve. Recoverable coal extends to the limit of abandoned workings.

Case 3 - a 6.5 feet (2 m) pillar is left between the base of the highwall and abandoned workings. Feather-edge coal is included in the total volume of the reserve.

Case 4 - a 6.5 feet (2 m) pillar is left between the base of the highwall and abandoned workings. The feather-edge coal is excluded from the total volume of the reserve.

Tables 1 and 1A (imperial, metric) summarize the parameters associated with each of the above cases as well as pertinent overburden information. A complete copy of the No. 3 crown pillar report will be available on open file at the Nova Scotia Department of Mines and Energy early in 1985.

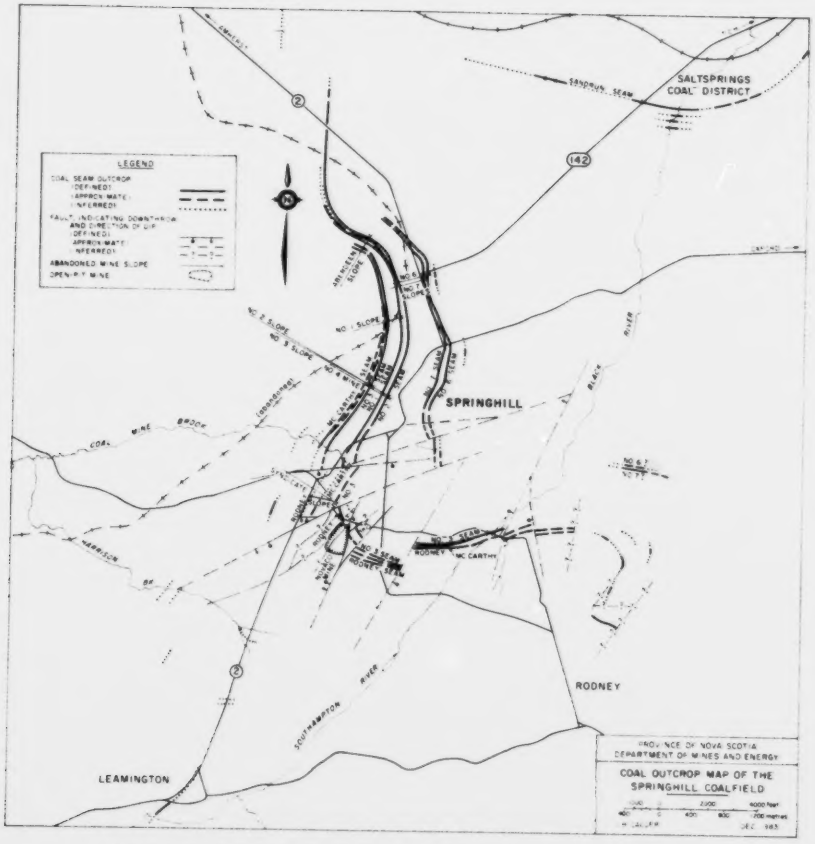

Figure 1. Coal outcrop map of the Springhill coalfield.

Table 1. No. 3 seam - Springhill coal summary (imperial)

			COAL QUALITY							OVERBURDEN			
Case* Number	Zone** Number	Coal (Short Tons)	M%	A%	S%	V%	F.C.%	Btu's/lb.	S.G.	Total (yd.^{3})	S.R.+	Less Waste Material (yd.^{3})	S.R.+
1	A	124,427	2.97	12.60	1.88	29.87	54.56	12,327	1.44	638,839	5.1:1	423,350	3.4:1
1	B	42,734	2.69	13.83	1.74	29.72	53.75	12,022	1.47	140,208	3.3:1	122,178	2.9:1
1	A + B	167,161	2.89	12.91	1.84	29.83	54.35	12,249	1.44	779,047	4.7:1	545,528	3.3:1
2	A	110,105	2.99	12.59	1.87	29.87	54.54	12,322	1.44	638,839	5.8:1	423,350	3.8:1
2	B	39,737	2.69	13.81	1.74	29.73	53.77	12,024	1.47	140,208	3.5:1	122,178	3.1:1
2	A + B	149,841	2.91	12.91	1.84	29.83	54.33	12,242	1.45	779,047	5.2:1	545,528	3.6:1
3	A	117,830	2.97	12.55	1.88	29.89	54.60	12,331	1.44	638,839	5.4:1	423,350	3.6:1
3	B	40,356	2.69	13.82	1.74	29.73	53.76	12,024	1.47	140,208	3.5:1	122,178	3:1
3	A + B	158,186	2.89	12.87	1.84	29.84	54.39	12,253	1.44	779,047	4.9:1	545,528	3.4:1
4	A	103,990	3.01	12.54	1.86	29.88	54.59	12,328	1.44	638,839	6.1:1	423,350	4.1:1
4	B	37,359	2.68	13.80	1.73	29.74	53.79	12,027	1.47	140,208	3.8:1	122,178	3.3:1
4	A + B	141,349	2.92	12.87	1.82	29.84	54.38	12,248	1.45	779,047	5.5:1	545,528	3.9:1

*Case 1 - includes total seam from subcrop to limit of old workings.
Case 2 - includes total seam minus feather-edge (subcrop) coal.
Case 3 - includes total seam minus coal left in 6.5 ft. barrier pillar.
Case 4 - includes total seam minus feather-edge coal minus coal left in 6.5 ft. barrier pillar.
**For Zone designations see Evaluation of the No. 3 seam, Crown Pillar, Springhill, Nova Scotia, by S. Chesal and R. Naylor; Nova Scotia Department of Mines and Energy, unpublished report, December 1984.
+Strip ratios are cubic yards overburden per short ton of coal.

Table 1A. No. 3 seam - Springhill coal summary (metric)

			COAL QUALITY							OVERBURDEN			
Case* Number	Zone** Number	Coal (Tonnes)	M%	A%	S%	V%	F.C.%	Btu's/lb.	S.G.	Total (m^3)	S.R.+	Less Waste Material (m^3)	S.R.+
1	A	112 880	2.97	12.60	1.88	29.87	54.56	12,327	1.44	488 409	4.3:1	323 662	2.9:1
1	B	38 768	2.69	13.83	1.74	29.72	53.75	12,022	1.47	107 193	2.8:1	93 408	2.4:1
1	A + B	151 648	2.89	12.91	1.84	29.83	54.35	12,249	1.44	595 602	3.9:1	417 070	2.7:1
2	A	99 887	2.99	12.59	1.87	29.87	54.54	12,322	1.44	488 409	4.9:1	323 662	3.2:1
2	B	36 049	2.69	13.81	1.74	29.73	53.77	12,024	1.47	107 193	3:1	93 408	2.6:1
2	A + B	135 936	2.91	12.91	1.84	29.83	54.33	12,242	1.45	595 602	4.4:1	417 070	3:1
3	A	106 895	2.97	12.55	1.88	29.89	54.60	12,331	1.44	488 409	4.6:1	323 662	3:1
3	B	36 611	2.69	13.82	1.74	29.73	53.76	12,024	1.47	107 193	2.9:1	93 408	2.5:1
3	A + B	143 506	2.89	12.87	1.84	29.84	54.39	12,253	1.44	595 602	4.1:1	417 070	2.9:1
4	A	94 340	3.01	12.54	1.86	29.88	54.59	12,328	1.44	488 409	5.2:1	323 662	3.4:1
4	B	33 892	2.68	13.80	1.73	29.74	53.79	12,027	1.47	107 193	3.2:1	93 408	2.8:1
4	A + B	128 232	2.92	12.87	1.82	29.84	54.38	12,248	1.45	595 602	4.6:1	417 070	3.2:1

*Case 1 - includes total seam from subcrop to limit of old workings.
Case 2 - includes total seam minus feather-edge (subcrop) coal.
Case 3 - includes total seam minus coal left in 2 m barrier pillar.
Case 4 - includes total seam minus feather-edge coal minus coal left in 2 m barrier pillar.
**For Zone designations see Evaluation of the No. 3 seam, Crown Pillar, Springhill, Nova Scotia, by S. Chesal and R. Naylor; Nova Scotia Department of Mines and Energy, unpublished report, December 1984.
+Strip ratios are cubic metres overburden per tonne of coal.

COAL EXPLORATION IN ALLUVIAL FAN-LACUSTRINE SETTINGS: THE SALT SPRINGS AND ROSLIN DISTRICTS OF THE CUMBERLAND BASIN

J. H. Calder and R. D. Naylor

Coal exploration studies conducted by the Coal Section (J. Calder, and R. Naylor, assisted by G. Somers and P. Watson) within the Cumberland Basin in 1984 were concentrated in the Salt Springs and Roslin coal districts (Fig. 1). The coals of these two districts are, in part, associated with a bivalve (pelecypods and ostracods) fauna occupying a preferred belt subparalleling alluvial fans developed on the northern side of the Cobequid Highlands, attributed by Calder (1981) to a shallow lacustrine association.

The Basin architecture and depositional model suggested (Calder, 1984a) is one with fluvial deposition transverse to the coalescing mature alluvial fans on the southern Basin margin (Cobequid Highlands). Distally, toward the Basin centre, subordinate lacustrine and flood-basin systems existed with the lacustrine perimeter marked by bivalves. Coal deposition is inferred to have taken place near the distal toes of abandoned fans near the lacustrine shoreline.

The investigation comprised three aspects: 1) diamond-drilling of four holes (SH96, SH97, SH98, SS8) in the Salt Springs coal district and one (R-1) in the Roslin district; 2) preliminary sedimentology studies of the alluvial fan deposits of the basal Cumberland Group; and 3) stratigraphic and sedimentologic mapping of the Riversdale and Cumberland Groups (primarily along Black River near Salt Springs).

STRATIGRAPHY AND SUMMARY SEDIMENTOLOGY OF COAL MEASURES

Salt Springs

Diamond-drilling in the Salt Springs area was designed as a follow up to drilling conducted by the Department in 1974-77. Previous drilling did not result in a clear understanding of the stratigraphy, so the correlation of coal seams (notably the Sandrun seam) was also unclear. The 1984 program was successful in establishing a stratigraphic framework, and allowed interpretations of trends in coal deposition and quality.

The coal-bearing facies assemblage at Salt Springs is estimated to be approximately 1,837 feet (560 m) thick as exposed on Black River. A transitional lithofacies change is evident upward and eastward along strike in the sections intersected in the drillholes. The transition is one from poorly developed fluvial deposition with lacustrine influence to well developed thick fluvial sandstones and associated floodplain fines. The latter facies association is evidently more conducive to significant peat swamp development as evidenced by an accompanying increase in seam thickness and quality eastward. Within this transition, the major coal seam (the Sandrun seam) thickens from 2 feet 3 inches (0.69 m) in SH96 to 6 feet (1.80 m) in SS8 over a lateral distance of 4,100 feet (1250 m).

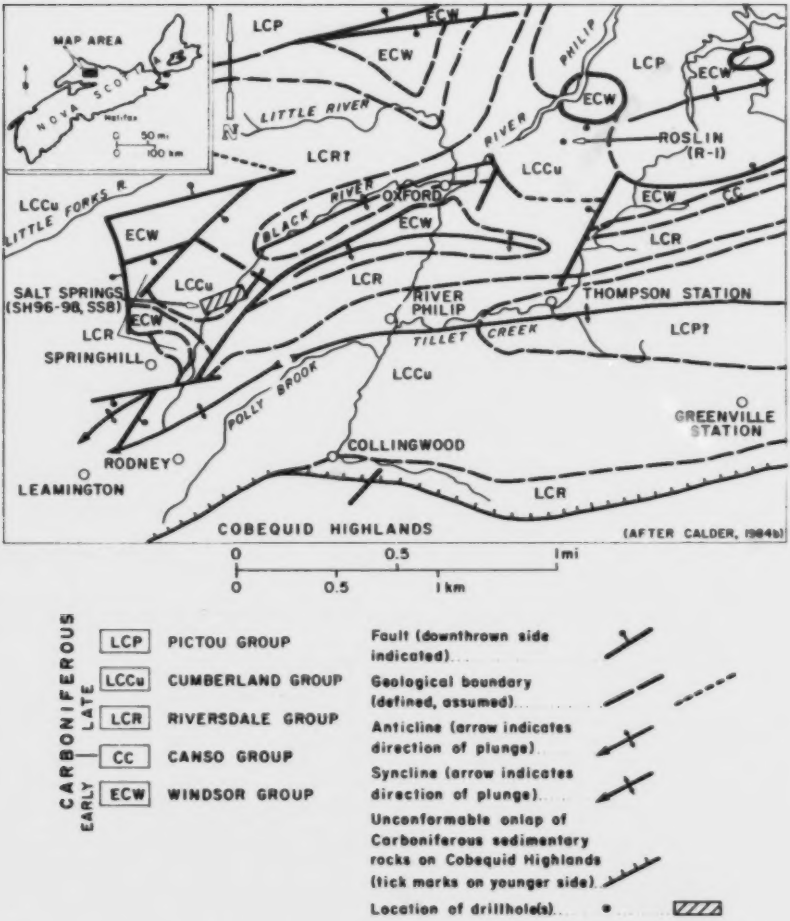

Figure 1. Simplified geological map of Salt Springs-Roslin region, Cumberland Basin, Cumberland County.

COAL CHARACTERISTICS

The Sandrun seam is best developed in hole SS8, in both quality and thickness. The volumetrically weighted ash and sulphur contents of the seam in SS8 are 25.18% and 5.90% respectively. The high sulphur

content is typical of coals associated with bivalve-bearing roof strata such as those of the Joggins-Chignecto coalfield.

At present it is unknown whether the eastward increase in coal thickness and quality persists beyond SS8. Preliminary estimates of strip ratio and tonnage for open-pit mining in the vicinity of hole SS8 were conducted by S. Chesal of the Coal Section. A strip ratio of 18:1 is indicated. The increase in dip eastward from 38° at Black River to 51° in hole SS8 is a reflection of the proximity of the Windsor Group evaporite-cored Claremont Anticline.

The megascopic petrography of the Sandrun seam in hole SS8 is summarized in Table 1, and the seam profile is depicted in Figure 2.

Table 1. Summary of coal lithotypes of the Sandrun seam, drillhole SS8, Salt Springs coal district.

LITHOTYPE	THICKNESS (ft.)	(m)	% OF TOTAL
Vitrain	0.10	0.03	2.3
Clarovitrain	-	-	-
Vitroclarain	0.33	0.10	7.8
Clarain	1.05	0.32	24.8
Duroclarain	0.52	0.16	12.4
Clarodurain	0.85	0.26	20.2
Durain	0.30	0.09	7.0
Fusain	0.07	0.02	2.9
Shaly coal	0.52	0.16	12.4
Coaly shale	0.49	0.15	11.6

Roslin

One hole (R-1) was drilled at Roslin, near Oxford, the first in a limited program to assess structural and coal depositional trends in the district. Hole OX-BP-9, drilled at Roslin in 1981 by BP Canada as a follow-up to Nova Scotia Department of Mines and Energy Coal Section mapping, intersected two thin impure coal seams immediately overlying the basal conglomerates of the Cumberland Group.

The facies associations observed include extrabasinal pebble conglomerate and indurated poorly sorted arenaceous siltstones interpreted as distal alluvial fan deposits, interfingering with a fluvio-lacustrine association characterized by thick bivalve-bearing mudstones, semirhythmically laminated siltstones and sandstones and thin impure coals. These associations are subsequently overlain by fining-upward multistoried sandstones and mudstones interpreted as meandering fluvial deposits and overbank facies. These deposits are in turn overlain by fluvial sandstones with associated reddish-brown to mottled mudstones with common calcrete nodules, suggesting a well drained environment not conducive to coal formation.

PRELIMINARY SEDIMENTOLOGY OF BASAL CUMBERLAND GROUP

Observations by the authors have indicated that the areal distribution of Cumberland coals, particulary those associated with lacustrine

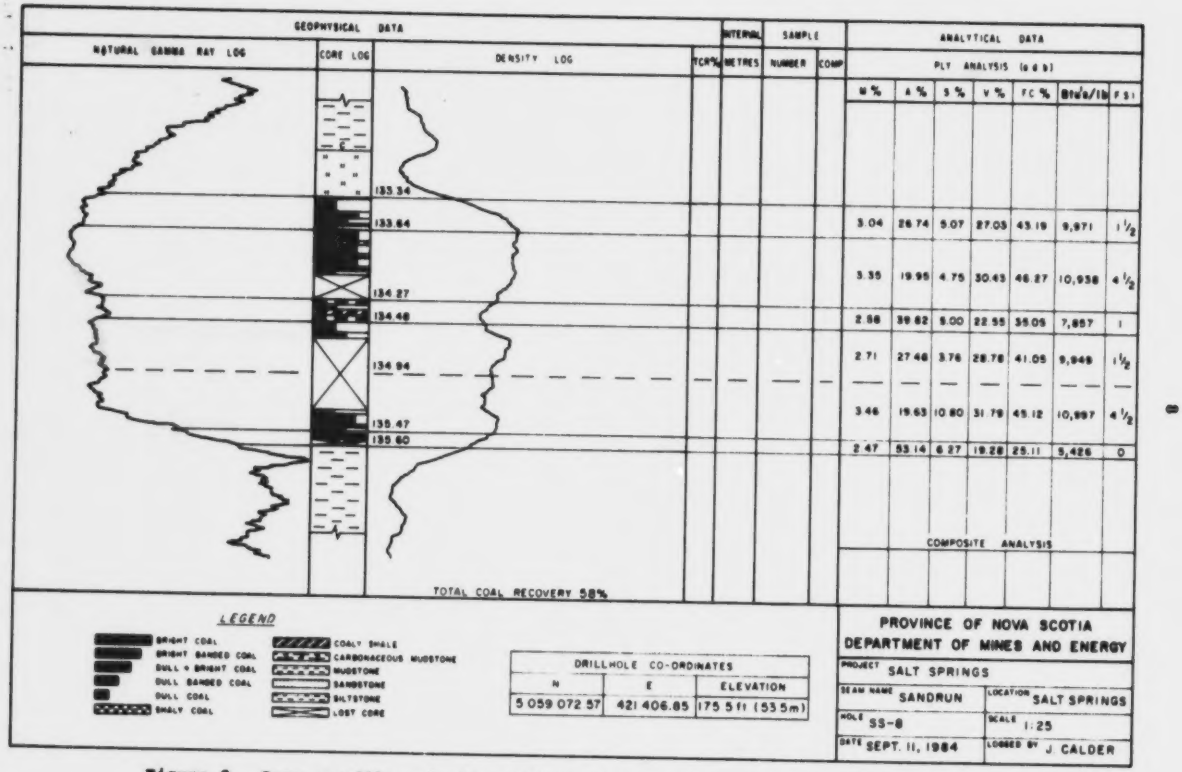

Figure 2. Seam profile of the Sandrun seam, Salt Springs, Cumberland County.

fauna, is closely related to paleogeography especially the position of alluvial fans over which the coals onlap. In order to better characterize these coalescing fans, the preliminary investigation of the sedimentology of these deposits was undertaken.

The basal Cumberland Group, informally designated the lower coarse facies by Shaw (1951), has tentatively been given the status of facies assemblage following the scheme of Gibling and Rust (1984). (Facies is used by Shaw (1951) to refer to major stratigraphic packages of lithofacies, with laterally transitional natures. In this paper facies is used in reference to individual lithofacies). It can be subdivided into two subassemblages: 1) a muddy matrix conglomeratic subassemblage suggesting debris flow; and 2) a sandy matrix conglomeratic subassemblage with subsidiary fluvial sandstones, in places transitional to coal measures. The mud matrix subassemblage is deduced to represent a proximal alluvial fan setting and commonly occurs lower in the assemblage, particularly near the unconformable contact with Cobequid rocks. The sand matrix subassemblage appears higher in the assemblage and represents intermediate to distal alluvial fan deposition with greater fluvial influence. The better sections of those observed were selected for clast lithology studies and detailed sedimentologic description. Clast lithologies can be correlated with units presently exposed in the Cobequid Highlands.

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DEPOSITIONAL ENVIRONMENT OF THE WESTPHALIAN B CUMBERLAND BASIN COALS OF SPRINGHILL, NOVA SCOTIA*

J. H. Calder

The Westphalian B coals of Springhill are part of a sequence of nonmarine, largely fluvial sediments reaching a maximum thickness of 3,609 feet (1100 m) which comprises the lower fine facies of the Cumberland Group. A depositional model first proposed in 1980 has been significantly refined and expanded. Elongate coal swamps with an approximate width of 3 miles (5 km) fluorished between a controlling trunk fluvial system and alluvial fans of the lower coarse Cumberland facies. The mature fans over which the coal measures progressively onlap contributed rogue ephemeral streams which invaded the southern margin of the coal swamps. Megascopic and microscopic coal petrography indicate a forest swamp environment. Regional three dimensional geometry of the controlling fluvial system is known through extensive diamond-drilling and much insight into the specific fluvial subenvironment has been gained through exposures within the Novaco open-pit mine on the Rodney seam. A modified meandering system is envisaged with extensive channelling by chutes of point bars, transitional to complete excision of bars resulting in a braided configuration within a meandering bed.

Incorporation of this model into tentative basin fill patterns suggests early dominantly transverse flow with fluvial deposition from a semimature alluvial plain and the presence of a subordinate lacustrine/megaflood basin near the present axis of the Cumberland coal basin. Subsequent deposition and basin infilling gave rise to dominantly longitudinal fluvial systems paralleling mature fans bordering the Cobequid Highlands. Bivalve-associated coals of the Joggins-Chignecto, Salt Springs, and Roslin coal districts may correspond to the transverse flow model.

*Atlantic Geoscience Society Colloquium, Amherst, Nova Scotia, January 1984.

GEOLOGY OF THIN COAL SEAMS NEAR DONKIN, CAPE BRETON COUNTY

D. J. MacNeil

In late 1983, a drill program to complete the evaluation of potential near-surface coal resources in the Donkin area east of Glace Bay was undertaken by the Coal Section of the Nova Scotia Department of Mines and Energy. The fact that the Gardiner, Odell, and McRury seams subcrop south of Donkin led the Department in 1978 to drill five reconnaissance holes along approximately 2 miles (3 km) of strike-length of the section (Gillis, 1979). Indications from that drilling program are as follows:

a) The Gardiner seam existed only as a coaly shale horizon about 8 inches (20 cm) thick.

b) The Odell seam was intersected in two holes with thicknesses of 1.01 feet (31 cm) and 1.64 feet (50 cm).

c) The McRury seam was intersected in three holes; in two of these holes, it occurred in two leaves with an aggregate coal thickness of 3.90 feet (1.19 m) and 4.33 feet (1.32 m). In the other, a single leaf, 2.69 feet (82 cm) thick, was intersected. Proximate analyses indicated a poor quality coal with greater than 15% ash and 8% sulphur.

These discouraging results led to a low priority being placed on further work to define any potential coal resources in the area. The project undertaken in 1983-84 was designed to fill in gaps, confirm the earlier results, and clarify the geology of the thin seams.

RESULTS OF INVESTIGATION

In late 1983, five core-holes were drilled for a total of 1,148 feet (350.0 m) (Fig. 1.). The McRury seam, which was the primary target, was intersected in four holes. Two of the holes were extended to penetrate the Odell and Gardiner horizons to help determine stratigraphic relationships within the section. The holes were geophysically logged (natural gamma and bed resolution density) with detailed logs run over seam intersections, and coal sampled for proximate analyses. A summary of the results of the program follow.

Gardiner Seam

The Gardiner seam, which is 5 feet (1.5 m) thick in the axial region of the Glace Bay Syncline at Reserve Mines, 8 miles (13 km) to the west has deteriorated at Donkin to a 0.5 feet (15 cm) thick horizon of carbonaceous to coaly shale. This confirms a trend observed in drilling programs east of Sydney Airport (Oldale, 1972; MacNeil, 1982) in which a consistent eastward decrease in thickness was noted.

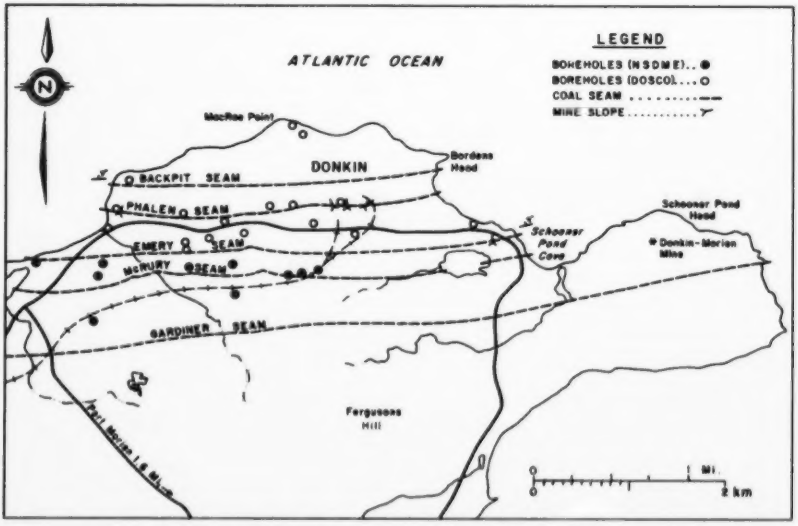

Figure 1. Location of coal seams and drillholes, Donkin area, Cape Breton, Nova Scotia.

Odell Seam

The Odell Seam, approximately 82 feet (25 m) above the Gardiner seam, is a well defined seam which decreases from 2.03 feet (62 cm) to 1.57 feet (48 cm) from west to east within the Donkin resource area. Analyses also indicate a strong increase in both ash and sulphur content from west to east. Within the seam, there is a marked deterioration in quality from roof to pavement, approaching shaly coal near the base.

In a regional context, the Odell seam thickens to 5 feet (1.5 m) or more in a westerly direction, but this increase is largely due to development of mudstone partings. The seam terminates by splitting in the Bridgeport Basin area.

McRury Seam

The McRury seam, about 262 feet (80 m) stratigraphically above the Odell is quite variable in thickness, ranging from 2.39 feet (73 cm) to 4.33 feet (1.32 m) with a 2.07 feet (63 cm) parting. It appears that a split develops in the seam south of Donkin, the parting being wedge-shaped with a northly to northwesterly(?) trending hinge-line. The upper leaf appears to pinch out to the east in this area, though it again appears in a coastal exposure of the McRury seam east of Schooner Pond Cove.

Geochemically, the McRury is a markedly high sulphur seam. A composite sample from two drill core intersections revealed 7.87% sulphur

and 12.27% ash, reported on a dry basis. Total sulphur is 91% pyritic, occurring megascopically as lenses up to 0.8 inches (2 cm) thick along bedding.

The Portal Sandstone

A feature of interest is a massive sandstone unit which occurs in the interval between the Odell and McRury seams, and has been termed the Portal Sandstone by Cape Breton Development Corporation personnel because the portals of the Donkin-Morien mine tunnels were developed in it. It consists of a stacked sequence of fining-upward units, each marked by a thin lag deposit at the base. Cycles in the upper half of the sequence occasionally fine to mudstone, but those in the lower part rarely grade finer than fine grained sandstone. The unit as a whole is about 197 feet (60 m) thick with the lower sandstone being about 98 feet (30 m) thick. The unit has been traced for 3.75 miles (6 km) along strike and extends at least 1.25 miles (2 km) downdip.

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NOVA SCOTIA OIL SHALE STUDY*

R. Naylor, P. Watson and S. Chesal

The Nova Scotia oil shale study was initiated as a follow up to the work of Macauley and Ball (1984) who determined the organic geochemistry of oil shales of the Stellarton and Big Marsh areas of Nova Scotia. The primary emphasis of the present three year program will be to detail the stratigraphy and environment of deposition of the oil shales and asssociated clastics of the Stellarton and Big Marsh areas. Gaining an understanding of the geology of these Nova Scotia oil shales will further aid in assessing their potential use as an energy resource. Preliminary work has already begun in the Pictou Basin and the results are briefly discussed below.

PICTOU BASIN

The Pictou Basin is located directly south of the Town of New Glasgow, Nova Scotia. The oil shales of the Pictou Basin are found within the coal-bearing Late Westphalian B to Westphalian C age Stellarton Group, which comprises the major lithostratigraphic group outcropping in the Basin. Initially, the present study was confined to the two uppermost members of the Stellarton Group, the Thorburn and Coal Brook Members.

Detailed field descriptions of outcrop sections and core were used to define lithofacies within the Thorburn and Coal Brook Members as a first stage of the study. Following the documentation of the stratigraphic distribution of these lithofacies, they will be grouped into lithofacies assemblages, each representative of a major depositional system. Presently it is only possible to identify general, commonly occurring associations of lithofacies, which probably represent a number of depositional systems. To date two major lithofacies associations have been identified and tentatively named the coarse and fine lithofacies associations. The two associations are readily distinquishable on the basis of their unique lithofacies, and on the relative abundance of common lithofacies. A very brief description of lithofacies comprising the two associations is outlined below.

Coarse Lithofacies Association

The coarse association is characterized by the occurrence of lithofacies which are generally coarser grained than those found in the fine association. Trough to lenticular bedded, multistoried, fining upward grey pebble conglomerates, and fine- to medium-grained lenticular sandstones are unique to the coarse association. Tabular bedded fine grained grey sandstones occurring as both discrete and multistoried units are common. Distinct carbonaceous parallel and ripple laminae occurring within the sandstones are characteristic of this lithofacies association.

The finer grained lithofacies of the coarse association are grey to black mudstones and shales. The mudstones are generally grey and vary

*Canada-Nova Scotia Mineral Development Agreement
Funded by Province of Nova Scotia

from massive to rhythmically layered. The shales, distinguished by their fissility, are grey to black with laminae averaging 0.04-0.12 inches (1-3 mm) in thickness. Alternating pale grey to grey and dark grey to black microlaminae as thin as 0.01 inches (0.3 mm) are also occasionally found. Ostracods, fish remains and plant fragments are usually rare, but occasionally abundant.

Petroliferous shales represent an end member of the shales described above. The petroliferous shales are generally black to dark grey and when scratched with a knife exhibit a waxy, brown streak. In some instances the petroliferous shales lose their fissility and become massive to canneloid in appearance. These massive petroliferous shales have been historically called torbanites. However, the so-called torbanites of the coarse association are distinctly different in appearance from torbanites of the fine association. The torbanites of the coarse association are coarser grained in appearance and do not as clearly exhibit the distinctive conchoidal fracture of the fine association torbanites.

Coals of this association observed to date tend to be microbanded and occasionally directly overlain by what appears to be coarse association torbanites and oil shales.

Fine Lithofacies Association

The fine association is predominantly made up of laterally continuous, rhythmically laminated lithofacies composed of very fine grained grey sandstones, siltstones, silty mudstones and shales. Typically the nonshale lithofacies grade vertically into one another over a 16.4-32.8 foot (5-10 m) interval through a gradual fining upwards in grain size, and reduction in laminae thickness. The laminae of the sandstones and siltstones often exhibit normal grading. Laminae thicknesses typically range from 0.01 inches (0.3 mm) in the finer grained sediments to 3.9 inches (10 cm) in the sandstones.

The fining upward sequence of rhythmically layered lithofacies is regularly interrupted by laterally continuous massive and occasionally laminated tabular sandstones and siltstones averaging 0.79-1.97 inches (2-5 cm) in thickness. These sandstones and siltstones are distinctive due to their resistance to weathering and slight pinkish hue. They typically occur every 2.0-11.8 inches (5 to 30 cm) within the rhythmically layered lithofacies sequence. Carbonaceous laminae and plant fragments are rare in the nonshale lithofacies.

The contact between the nonshale and shale lithofacies is usually quite abrupt and often marked by an increase in plant fragments at the boundary. The shales of the fine association are very similar to those of the coarse association. The petroliferous oil shales, however, gradually grade vertically through a thinly laminated black oil shale to a well developed torbanite oil shale. The torbanite is easily distinguishable on the basis of its low specific gravity, well developed conchoidal fracture, and lack of fissility.

Ostracods, plant fragments and fish remains are generally rare, but occasionally abundant in the central basin lithofacies association.

SUMMARY

Field work to date for the Nova Scotia oil shale survey has been concentrated in the Pictou Basin. Emphasis has been placed on the identification of lithofacies and lithofacies associations within two of the oil shale bearing members of the Stellarton Group. Ultimately these lithofacies descriptions will be used to aid in detailing the stratigraphy and environment of deposition of the oil shales and associated clastics of the Pictou Basin.

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PEATLAND INVENTORY PROGRAM

A. R. Anderson and W. Brougham

INTRODUCTION

Peat is an accepted alternate fuel for energy production in many countries around the world. For several decades, peat fuels have been used at all scales of energy production.

Nova Scotia has about 400,000 acres (160 000 ha) of peatland (about 4 per cent of the Province) concentrated in five or six regions of the Province (Fig. 1). Areas in Victoria, Inverness, Cape Breton and Richmond Counties were assessed this year to determine the extent of their peat resource. This was the last year for field studies. We are now working on a final publication on Nova Scotia peatland resources, and investigating the possibility of developing this important resource.

Figure 1. Peatland concentration regions in Nova Scotia.

PREVIOUS WORK BY THE PROGRAM

The inventory program from 1980 to 1983 investigated peat deposits in Yarmouth, Shelburne, Queens, Kings, Hants, Cumberland, Halifax, and Guysborough Counties (Table 1).

Yarmouth, Shelburne, and Queens Counties (1980-83) comprise the southwestern Nova Scotia study area (Fig. 1). A total of 41,325 acres (16 725 ha) of peatland have been evaluated with reserves of 489 million cubic yards (374 million m^3) of in situ peat. Relative tonnages (at 50% moisture content*) indicate that 62 per cent of the peat inventoried in this region is estimated to be suitable fuel grade** peat.

Deposits inventoried in Hants County (1982) cover about 5,400 acres (2200 ha). These peatlands contain approximately 105 million cubic yards (80 million m^3) of in situ peat of which 36 per cent is fuel grade peat.

Deposits evaluated in Cumberland County (1983) contain approximately 115 million cubic yards (87 million m^3) of in situ peat. An area of 8,600 acres (3500 ha) of peatland was studied, and data indicate that 25 per cent of the peat could be classed as fuel grade.

Guysborough County peat deposits (1983) are generally quite small, but numerous. About 150 deposits were sampled revealing approximately 128 million cubic yards*** (98 million m^3) of which 20 per cent by weight can be classified as fuel grade peat. A total of 16.54 million tons+ (15 million t) were investigated in this region.

Peatland in Halifax and Kings Counties were not targeted to be investigated by this inventory program. However, special interests necessitated the evaluation of 650 acres (263 ha) of peatland in Halifax County and 1,245 acres (504 ha) in Kings County. Volumes of 10 and 14 million cubic yards (8.0 and 11.0 million m^3) were studied of which 17 per cent and 57 per cent were found to be of fuel grade quality respectively.

AREAS INVESTIGATED 1984

Cape Breton Island

The deposits evaluated in Cape Breton and Richmond Counties represent approximately 111 million cubic yards (85 million m^3) of peat (Fig. 2) of which about 25 per cent is classed as fuel grade. The bogs are on average 8.9 feet (2.7 m) in depth, although some are as deep as 23 feet (7 m). Data from the 36 deposits inventoried show large amounts of good quality moss grade++ peat that could be developed for horticultural use.

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*In situ weight is calculated at 50 per cent moisture content.
**Fuel grade - peat between 5 and 10 on von Post humification scale.
***All volumes expressed are in situ.
+All tonnages expressed are in situ at 50 per cent moisture content.
++Moss grade - peat between 1 and 4 on von Post humification scale.

Table 1. Resource data from inventoried deposits (1980-84).

Region	Area Investigated		Average Depth		In Situ Volume				Tonnage* $x10^6$ tons		% Fuel Peat By Weight
					Fuel Peat		Total Resource Inventoried				
	acres	(ha)	ft.	(m)	$x10^6$ yds^3	($x10^6 m^3$)	$x10^6$ yds^3	($x10^6 m^3$)	Fuel	Total	
Southwestern Nova Scotia	44,160	(17 875)	6.9	(2.1)	289	(229)	521	(400)	45	70	62
Halifax Co.	650	(263)	10.2	(3.1)	1.4	(1.1)	10.5	(8.0)	0.2	1.3	17
Kings Co.	1,250	(504)	7.2	(2.2)	7.2	(5.5)	14.4	(11.0)	1.2	2.1	57
Hants Co.	5,527	(2 237)	10.5	(3.2)	37.9	(29.0)	104.6	(80.0)	6.1	14.3	42
Cumberland Co.	8,650	(3 500)	8.2	(2.5)	28.8	(22.0)	113.8	(87.0)	4.6	15.1	31
Guysborough Co.	9,640	(3 900)	8.2	(2.5)	26.1	(20.0)	128.2	(98.0)	4.4	16.5	27
Cape Breton (West)	4,300	(1 740)	5.2	(1.6)	6.5	(5.0)	34.7	(26.5)	1.1	4.5	24
Cape Breton (East)	7,860	(3 180)	8.9	(2.7)	22.9	(17.5)	110.2	(84.6)	3.6	14.4	25

*Tonnage is calculated at 50% moisture content of in situ peat.

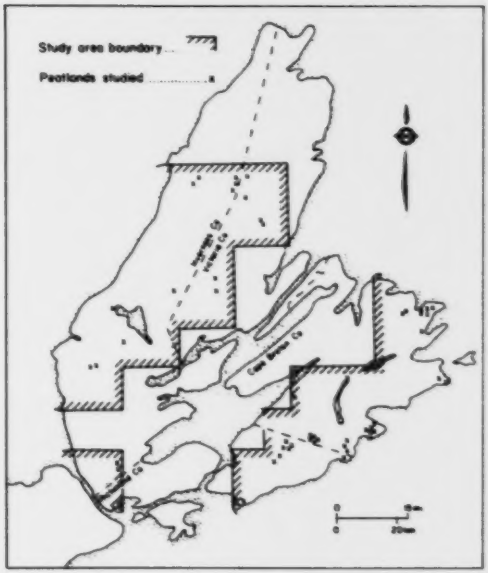

Figure 2. Areas investigated, Cape Breton Island (1984).

The 4,300 acres (1740 ha) of peatlands inventoried in Victoria and Inverness Counties of western Cape Breton represent approximately 35.3 million cubic yards (27 million m^3) of peat of which 24 per cent can be classed as fuel grade. On average, peat was 5.3 feet (1.6 m) in depth; however, sampling depths did reach 15.1 feet (4.6 m). On the whole, peat resources in this region consist of moss grade peat with few exceptions.

A peat deposit in the Lake Ainslie area has been recommended as an ecological preserve because of its unique vegetation and stratigraphy.

Cape Breton Island is estimated to have a total resource of approximately 752 million cubic yards (575 million cubic m^3) of peat in approximately 62,659 acres (25 358 ha) of peatland. Moss grade peat is estimated to represent 75 per cent of the peat in this region.

Southwestern Nova Scotia

Additional deposits in Yarmouth and Shelburne Counties (Fig. 3) were surveyed to complement work done in earlier field seasons. The survey covered 2,840 acres (1150 ha) of peatlands revealing an additional 31

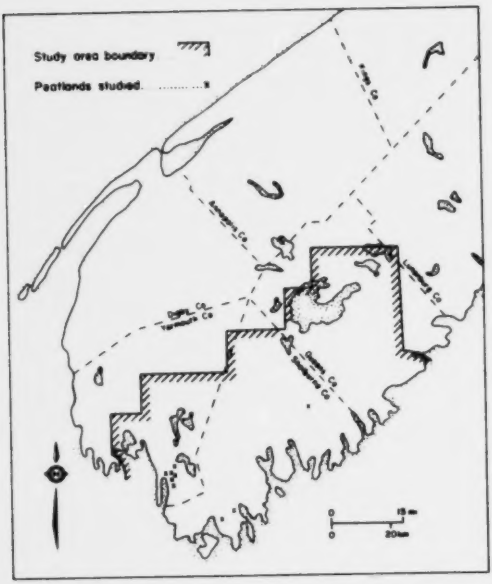

Figure 3. Areas investigated southwestern Nova Scotia (1984).

million cubic yards (24 million m^3) of peat of which 56 per cent is classed as fuel grade. Deposits surveyed were in the French-Pubnico Lake region of Yarmouth County and the Clements Pond and Blue Hill regions of Shelburne County.

SUMMARY

To date the Inventory Program has covered a total of 81,800 acres (33 100 ha) of peatlands on mainland Nova Scotia (Table 2). The volumes associated with this total area are 617 million cubic yards (472 million m^3) moss grade peat and 420 million cubic yards (321 million m^3) fuel grade peat. These volumes equate to 76 and 67 million tons (69 and 61 million t) respectively.

Extrapolation of these data provides estimates of total resource in the studied regions of 225 million tons (204 million t) of moss grade peat and 166.5 million tons (151 million t) fuel grade peat to date.

Table 2. Amount of resource surveyed by the Peatland Inventory Program

Region	Area Investigated[+] acres	(ha)	Area Surveyed[++] acres	(ha)	% of Resource Surveyed*
Southwestern Nova Scotia	94,000	(38 000)	44,160	(17 875)	47
Halifax Co.	34,875	(14 114)	650	(263)	2
Kings Co.	11,000	(4 451)	1,250	(504)	11
Hants Co.	14,460	(5 851)	5,327	(2 237)	37
Cumberland Co.	16,600	(6 700)	8,650	(3 500)	52
Guysborough Co.	35,500	(14 400)	9,640	(3 900)	27
Cape Breton (West)	23,150	(9 370)	4,300	(1 740)	19
Cape Breton (East)	39,500	(15 900)	7,860	(3 180)	20
Total Area Investigated	269,100	(108 800)	81,800	(33 100)	30
Province wide	395,350	(160 000)			20

[+]general region studied
[++]actual peatland area sampled
*Not all deposits surveyed because of logistics, access and commercial viability

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MINERAL EXPLORATION MONITORING ACTIVITIES

J. M. McMullin and P. D. McCulloch

Monitoring of mineral exploration activity is carried out by the Resource Geology Section of the Mineral Development Division. Staff assigned to this activity consists of a regional geologist and a project geologist, both based in the Stellarton, Pictou County, regional office of Nova Scotia Department of Mines and Energy.

The monitoring process includes visits to exploration sites and field offices of exploration companies, active liaison with exploration industry personnel, reviews of assessment and other reports submitted by industry, and an annual statistical survey of all operators to obtain data identifying costs and types of work done in the various sectors.

The data obtained are compiled, tabulated and summarized on an annual basis to identify long-term trends (Table 1), and to determine the general health of the exploration industry in the Province.

This monitoring activity provides a direct liaison between government and industry at the field and exploration office levels, which serves not only to provide information to the government on current activity, but also enables government geologists to provide advice and assistance to geologists in the field if required, and to learn of any concerns or difficulties which may need addressing by the Department.

An additional benefit resulting from the monitoring process is that all diamond-drill core generated in the Province is on record and may quickly be recovered for the Drill Core Library in Stellarton when no longer required by the company.

Monitoring was curtailed in 1984 owing to the project geologist position being vacant all year. The position was filled at the end of the year.

MINERAL EXPLORATION ACTIVITY IN 1984

Approximately 200 licence holders held claims during 1984 and at years end over 30,858 claims were held by means of exploration licences (1,062), development licences (29) and special licences (10). The exploration licence total includes 687 new licences representing 18,670 claims, and 375 renewals representing 6,950 claims.

The combined total of 30,858 claims is equivalent to 1,234,320 acres (437 155 ha) or about 10% of the area of the Province.

Approximately 20 major and 49 junior or private companies held claims in 1984 and of these about 10 major companies and about 16 junior companies had separate active exploration programs in 1984 (Fig. 1).

Table 1. Mineral exploration trends in Nova Scotia.

	1976	1977	1978	1979	1980	1981	1982	1983	1984*
Assessment Work Reported For Licence Renewals ($)*	1 600 000	3 800 000	5 900 000	4 700 000	7 564 000	8 441 270.30	4 107 273.20	4 200 210.58	2 625 666.00
Total Licences Issued	1 489	2 894	2 393	1 841	2 559	1 896	1 205	1 328	1 101
Claims Recorded									
General (base metals, gold, etc.)	35 434	70 936	38 597	40 497	88 703	72 907	40 084	40 630	26 631
Uranium	21 526	48 721	31 978	30 920	25 483	6 225	0	0	0
Salt, Potash	224	887	1 148	2 256	13 505	1 155	656	505	638
Coal							3 072	4 565	3 589
No. Mineral Assessment Reports	70	95	132	126	140	157	124	188	147

*Preliminary figures

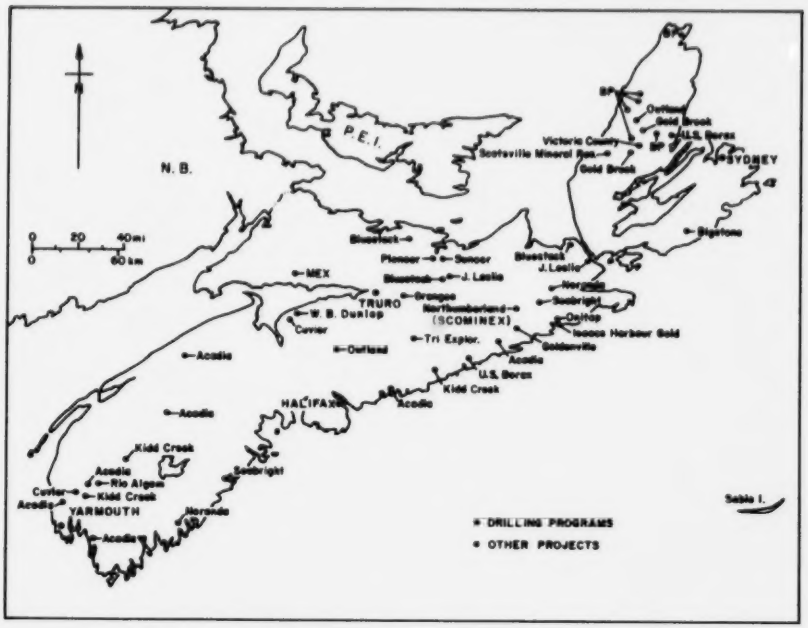


Figure 1. Locations of main exploration programs, 1984.

Nine major companies maintained offices in Nova Scotia in 1984 (Table 2). Of the active junior or private companies, ten had their principal field offices in Nova Scotia or were based in the Province (Table 3).

New arrivals in the Province included, among the majors, Durham Resources Inc., Inco Ltd. and BP Exploration Canada Ltd. BP re-entered the Province by means of their late 1983 acquisition of Selco Inc. Inco Ltd. is the operating company for a new joint venture formed in 1984 between Inco Ltd., Kennco Explorations Canada Ltd., Husky Oil Operations Ltd. and Canadian Offshore Resources Exploration Ltd. (COREL). COREL is a subsidiary of the Provincial crown corporation Nova Scotia Resources Ltd. The new joint venture is known as the Scotia Mineral Venture, or SCOMINEX, and is initially funded for 3 years for a total of 3 million dollars, primarily for gold exploration.

Among junior companies, new names on the scene include Scotsville Mineral Resources Ltd., Bigstone Minerals Ltd., Victoria County Explorations Ltd., Onitap Resources Inc., Meguma Gold Corporation Ltd., Athol Exploration Syndicate and Anglo Canadian Mining Corporation.

Table 2. Major exploration companies active in Nova Scotia.

	1982	1983	1984	1984 Office Location
Asarco Exploration Co. of Canada Ltd.	-	-	-	
Billiton Canada Ltd.	x	x	x	
CCH Minerals (Campbell Resources Inc.)	x	-	-	
Chevron Canada Resources Ltd.	x	-	-	
Conwest Exploration Company Ltd.	x	-	-	
Dome Exploration (Canada) Ltd.	x	-	-	
Durham Resources Inc.	-	-	x	
Duval International Corp.	x	-	-	
Eldorado Resources Ltd.	-	-	-	
Esso Minerals Canada	x	x	x	Halifax
Getty Minerals Company Ltd.	-	-	-	
Goldfields Mining Corporation	-	x	-	
Granges Exploration AB	x	x	x	Sackville
Inco Ltd.	-	-	x	Halifax
Kennco Explorations Canada Ltd.	-	-	x	
Kidd Creek Mines Ltd.	x	x	x	Windsor
Lacana Mining Corp.	x	x	x	New Glasgow
Noranda Exploration Company Ltd.	x	x	x	
Novacorp Engineering Services Ltd.	x	x	x	Halifax
Petro-Canada Resources Inc.	x	-	-	
Rio Algom Exploration Inc.	x	x	x	
Saarberg Interplan Canada Ltd.	-	-	-	
Selco Inc. (BP Resources Canada Ltd.)	x	x	x	Halifax
Shell Canada Resources Ltd.	x	-	-	
Sullivan Mines Inc.	-	x	-	
Sulpetro Minerals Ltd.	x	-	-	
Suncor Inc.	x	x	x	New Glasgow
U.S. Borax and Chemical Corp.	x	x	x	Halifax

x indicates field work carried out
- indicates inactive

Total expenditures for all exploration activity in Nova Scotia are estimated to be approximately $7,000,000 which is up $1,000,000 from 1983.

MINING EXPLORATION

Gold Exploration

Exploration in the historic gold districts of mainland Nova Scotia continued to dominate the search for precious metals in the Province during 1984. A large increase in the level of gold exploration was recorded in 1983 over 1982. Most of the exploration for gold is currently being carried out by the junior companies. The outlook for 1985 is bright with the new participation by major companies in the SCOMINEX joint venture.

Table 3. Junior exploration companies active in Nova Scotia.

	1982	1983	1984	1984 Office Location
Acadian Gold Mines Ltd.	-	x	-	
Acadia Mineral Ventures Ltd.	x	x	x	Truro
Anglo Canadian Mining Corporation	-	-	x	
Athol Exploration Syndicate	-	-	x	
Bear Pass Resources Corporation	-	x	-	
Bigstone Minerals Ltd.	-	-	x	
Blockhouse Resources Ltd.	x	x	-	
Bluestack Resources Ltd.	x	x	x	Truro
Borcan Resources Ltd.	x	x	-	
Coxheath Gold Holdings Ltd.	-	x	x	Halifax/ Bedford
Cuvier Mines Inc.	x	x	x	Truro
Entrepreneurial Management Ltd.	x	x	x	Halifax/ Bedford
Gold Brook Developments Ltd.	-	x	x	Margaree
Golden Caribou Explorations Inc.	-	x	-	
Golden Shadow Resources	x	x	-	
Goldenville Explorations Ltd.	-	x	x	
International Geochemical Associates	x	x	-	Halifax/ Bedford
Isaacs Harbour Gold Explorations Inc.	-	x	x	
Lake Mine Resources Inc.	-	x	x	
Louisbourg Property Holdings	x	x	-	Halifax/ Bedford
M.E.X. Explorations Ltd.	x	x	x	Truro
Meguma Gold Corporation Ltd.	-	-	x	Halifax/ Bedford
Northumberland Mines Ltd.	x	x	-	
Onitap Resources Inc.	-	-	x	
Outland Resources Corp.	x	x	x	
Pan-East Resources Inc.	x	x	-	
Scotsville Mineral Resources Ltd.	-	-	x	Halifax
Seabright Resources Inc.	x	x	x	Halifax
Trafalgar Resource Investments	x	x	-	Dartmouth
Victoria County Explorations Inc.	-	-	x	
Whiteburn Precious Metals Ltd.	x	x	-	Halifax/ Bedford

x indicates field work carried out
- indicates inactive

Exploration was concentrated primarily on the gold-bearing quartz veins of the Cambro-Ordovician metasedimentary sequence of the Meguma Group. The gold occurs in stratiform (saddle veins) and cross-cutting fault structures near the axis of anticlinal limbs in the regionally folded Meguma sedimentary rocks. The gold is free-milling and locally concentrated in discontinuous leads and roll structures with associated arsenopyrite and other minor sulphide mineralization. Most of

the production in the gold districts was undertaken during the latter part of the nineteenth century. The dramatic rise in the price of gold during the period 1978-80 sparked a resurgence in gold exploration and is reflected in the volume of activity in the former gold districts.

Several continuing exploration programs were carried out by a number of junior companies during 1984. **Acadia Mineral Ventures Ltd.** conducted geochemical surveys (continuation of 1983 program by Outland Resources Inc.) and a diamond drilling program at Miller Lake, Guysborough County. **Lake Mine Resources Inc.** carried out detailed geophysical surveys as part of a continuing evaluation of the Caribou Mines gold property, Halifax County.

Seabright Resources Inc. continued a large-scale exploration program on their Forest Hill property in Guysborough County consisting of geochemical and geophysical surveys, geological mapping, bulk sampling and diamond drilling. In addition to the Forest Hill property, the company carried out diamond drilling on the Mill Village gold property which was a minor producer at the turn of the century. Seabright is also continuing an evaluation of gold reclamation from tailings in several of the more productive gold districts throughout mainland Nova Scotia.

Goldenville Explorations Ltd. continued a large-scale exploration program on the Goldenville property near Sherbrooke, Guysborough County. The company continued their 1983 drilling program with an additional 10 holes in early spring and later carried out surface bulk sampling. A small crusher and concentrating facility were set up to handle the bulk sample material. **Northumberland Mines Ltd.** carried out geological mapping and bulk sampling on the Cochrane Hill property.

Tri-Explorations Limited (M.E.X.-Seabright joint venture) carried out a diamond drilling program early in the year at Caribou, Halifax County following the completion of a trenching and lithological sampling program the previous fall. The company also conducted minor geochemical work at Cochrane Hill. **Outland Resources Corp.** in association with **Anglo Canadian Mining Corporation,** continued their exploration program at Renfrew, Hants County (optioned from E. Horne and B. Taylor) consisting of geochemical and geophysical surveys, geological mapping, trenching and underground bulk sampling.

U.S. Borax and Chemical Corp. optioned ground from Sulpetro Minerals at Salmon River (Dufferin Mine), Halifax County and carried out a diamond drilling program to test geophysical targets obtained during an earlier exploration program. The company also carried out exploration for gold and associated base metal mineralization in the vicinity of St. Anns Mountain, Victoria County. **Onitap Resources Inc.** conducted a limited diamond-drilling program in the vicinity of the Boston-Richardson mine property at Goldboro, Guysborough County. Also at Goldboro, **Isaacs Harbour Gold Explorations Inc.** completed diamond drilling early in the year.

Victoria County Explorations Ltd. carried out a detailed exploration program on the Second Gold Brook gold property near Middle River, Victoria County consisting of geological mapping, trenching and underground development. An exploration adit was driven to intersect known

gold-bearing zones on the property for the purpose of sampling and evaluation.

Cuvier Mines Inc. carried out a reconnaissance geochemical sampling program for gold and associated base metals in the Ogden Lake-Fanning Lake area, Yarmouth County. As part of the same program, **Acadia Mineral Ventures Ltd.** carried out reconnaissance prospecting and geochemical sampling at East Kemptville, Lake George and Pubnico, Yarmouth County and at Maitland Bridge and Torbrook West, Annapolis County. Acadia also conducted a small geochemical program for gold at Lake Catcha, Halifax County.

Several small-scale exploration projects were also carried out by several companies during 1984. **Noranda Exploration Company Ltd.** conducted geochemical surveys at Sable River, Shelburne County and at North Ogden, Guysborough, the latter over Devono-Carboniferous sedimentary rocks. **Oldham Resources Ltd.** carried out trenching and lithological sampling on the Oldham gold property in Halifax County. **Gold Brook Developments Limited** carried out geophysical surveys at Le Blanc Lake and Campbell Brook, Inverness County and Middle River, Victoria County.

In addition to the above exploration programs, several minor projects were carried out by various companies and individuals.

Base Metal Exploration

Exploration for tin and tungsten continued to highlight exploration for base metals in Nova Scotia during 1984. The main focus is centred on greisen-hosted tin mineralization in specialized granites and granitic differentiates that intruded the Cambro-Ordovician sedimentary rocks of the Meguma Group, primarily in southwestern mainland Nova Scotia. Following the discovery of the East Kemptville tin deposit by Shell Canada Resources in 1980, several companies have continued large-scale projects to explore for similar economic deposits. **Rio Algom Limited** acquired the East Kemptville deposit from Shell in the fall of 1982 and a production decision was announced in the fall of 1983. The deposit is currently reaching the final stages of development and is expected to be in production by the end of 1985.

Most of the exploration for tin and tungsten was carried out by large mining companies including **Rio Algom Exploration Inc.**, **Billiton Canada Ltd.**, **Kidd Creek Mines Ltd.** and **BP Resources Canada Ltd.** Field programs consisted primarily of reconnaissance and detailed till sampling, prospecting, overburden drilling (auger drilling) and diamond drilling.

Continuing exploration by **Rio Algom Exploration Inc.** concentrated on the East Kemptville property primarily in the Duck Pond Ridge and Ikes Ridge areas west and southwest of the tin deposit. Work consisted of till sampling, geophysical surveys and diamond drilling.

Billiton Canada Ltd. continued a large-scale exploration program for tin in the Jeromes Lake area, Yarmouth County consisting of geological mapping and rock sampling, detailed till sampling and a large overburden drilling program.

Kidd Creek Mines Ltd. continued a detailed exploration program for tungsten in the Tangier-Grand Lake area, Halifax County consisting of geological mapping and prospecting, till sampling and rock sampling. The company also carried out a small exploration program for tin and tungsten near Pearl Lake, Yarmouth County consisting of till sampling, geological mapping and prospecting. A large group of claims in Digby County and the four adjoining counties was evaluated by geological and geochemical surveys.

A large exploration program for tin, tungsten and base metals was continued in several areas of the Cape Breton Highlands by **BP Resources Canada Ltd.** consisting of geological mapping, geochemical and geophysical surveys, rock sampling and trenching. These areas include Lake O'Law, Alder Brook, Two Brooks and Turner Brook in Inverness County and MacDonald Brook and Cape North in Victoria County.

Exploration for tin and tungsten as well as precious metals was carried out by **Cuvier Mines Inc.** near East Kemptville, Yarmouth County consisting of prospecting and geochemical sampling. **Acadia Mineral Ventures Ltd.** carried out prospecting and geochemical sampling for tin, tungsten and gold at Lake Torment, Kings County and Falkland Ridge, Annapolis County.

Exploration for copper, lead and zinc continued at the reduced levels that prevailed during the previous two years. The rejuvenated interest in gold and the turn to tin and tungsten exploration sparked by the success of Shell at East Kemptville has shifted emphasis away from copper, lead and zinc exploration. The principal operators of significant exploration programs for these metals in 1984 include **Granges Exploration AB, Bigstone Minerals Ltd.** and **BP Resources Canada Ltd.**

Granges Exploration AB continued their evaluation of the Smithfield Pb-Zn deposit, Colchester County and carried out additional diamond drilling during the summer. Originally discovered in 1875, the Smithfield deposit has published drill indicated reserves of roughly 550,000 tons grading 2.7% Pb and 3.5% Zn (Minda Scotia Mines Ltd., 1952).

Bigstone Minerals Ltd. commenced their evaluation of the Stirling massive sulphide zone, Richmond County and carried out geophysical surveys and diamond drilling. Total production for the Stirling mine was just over a million tons with grades as high as 1.0% Cu, 2.3% Pb, 10.0% Zn and 2.5 oz./ton Ag (1938 production figures).

BP Resources Canada Ltd. (Selco-Bluestack joint venture) continued a detailed follow-up program of a regional geochemical survey carried out in northeastern mainland Nova Scotia in 1981-83 by Bluestack Resources Ltd. Work consisted of detailed geochemical surveys, geological mapping, prospecting and basal till sampling.

Gold Brook Developments Ltd. carried out a small exploration project for base metals at Campbell Brook, Inverness County consisting of geophysical surveys.

Barite Exploration

Exploration levels for barite were somewhat reduced from the previous year with mostly small-scale programs being completed. The majority of the work was undertaken by junior companies with the remaining work undertaken by individuals.

M.E.X. Explorations Ltd. carried out a reconnaissance geochemical survey for barite in the Five Islands area, Colchester County. **Scotsville Mineral Resources Ltd.** carried out a detailed geochemical survey and a detailed diamond drilling program in the vicinity of the company's development site at Scotsville, Inverness County.

John A. Leslie & Associates Limited carried out geochemical and geophysical surveys, basal till sampling and trenching on a property near Bridgeville, Pictou County and geochemical surveys on a second property at Byers Brook, Guysborough County. A detailed feasibility study was also undertaken on the Walton deposit by a group representing W. B. Dunlop.

Cuvier Mines Inc. carried out a diamond drilling program southwest of the Walton mine site as part of a continuing exploration program in the Walton area, Hants County.

Coal Exploration

Suncor Inc. has carried out an extensive exploration program for coal in the Westville-Stellarton area since 1981 consisting primarily of detailed seismic studies and diamond drilling. The work carried out in 1984 consisted of additional diamond drilling and downhole geophysics, demethanation studies and a geological review and up-date of the Pictou coalfield.

The Nova Scotia Department of Mines and Energy also continued an exploration program for coal consisting of diamond drilling and downhole geophysics at three localities including Springhill (Cumberland County), St. Rose (Inverness County), and Thorburn (Pictou County).

MINING DEVELOPMENT

Gold

Minor development work consisting of bulk sampling was carried out by SCOMINEX (Scotia Mineral Exploration Venture) on the Northumberland Mines Ltd. gold property at Cochrane Hill, Guysborough County. The sampling was carried out in the test pit area just east of the mill site.

Base Metals

Development work on the East Kemptville tin deposit owned by **Rio Algom Ltd.** has continued on schedule with initial production expected by the end of 1985. Mineable reserves are estimated at 56 million tons grading 0.16% tin with copper and zinc to be produced as a byproduct. Development and construction costs to bring the open-pit mine into

production are estimated at $150 million. The mill is expected to operate at 9,000 tons per day at full capacity with an annual output of approximately 3.3 million tons of ore.

Barite

Scotsville Mineral Resources Ltd. initiated development work on their barite property at Scotsville, Inverness County. Detailed diamond drilling and sampling were carried out prior to the opening of an open-pit from which several thousand tons had been mixed by the end of 1984. Construction work commenced in the fall of 1984 to erect a crusher and jig concentrating plant which will be completed in the spring of 1985. **Conwest Exploration Company Ltd.** continued feasibility studies on the Trout Brook barite-fluorspar deposits just south of the Scotsville development on the eastern side of Lake Ainslie, Inverness County.

Nystone Chemicals Limited continued development work on the Brookfield barite deposit, Colchester County. A jig concentrating plant was set up on the property and the production of both mud-grade and pharmaceutical grade barite was undertaken.

Novex Mining and Exploration Company Limited continued their mining and development work on the Pine Brook barite deposit in Richmond County, but operations were terminated in August.

Coal

The Cape Breton Development Corporation continued development work on several projects in the Sydney coal basin, Cape Breton County including the Donkin mine (tunnelling and bulk sampling), the 1B mine (rehabilitation studies), and the Lingan/Phalen project (development work on the Phalen seam). In March and April **Pioneer Coal,** a subsidiary of **Nova Construction Co.** of Antigonish, commenced exploration on their newly acquired property in Westville, Pictou County (formerly the privately owned Drummond Coal Co.) with a large scale rotary drill program to outline near surface sections of the Acadia and Scott seams. A test pit was dug which quickly led to the development of open-pit production which is expected to continue for 10 years. A feasibility study is underway to determine the viability of a coal wash plant on site.

Suncor Inc. is currently undertaking feasibility studies related to future mine development on their coal exploration program in the Pictou coal basin.

INDUSTRIAL MINERALS

J. E. Fowler

Industrial mineral activity during the year (Fig. 1) continued at a high level with production value of 1984 expected to surpass that of 1983. Excluding aggregate production, there were twenty-two industrial mineral producers operating at thirty-three sites producing ten commodities including anhydrite, barite, clay and shale, dolomite, gypsum, limestone, salt, silica sand, stone, and peat moss. The Province's numerous aggregate producers operating in both granular and bedrock aggregate deposits supplied all Provincial requirements with two companies supplying aggregate materials to developing export markets nationally and internationally.

Along with production, industrial mineral activity by industry included commodity data compilation programs, exploration and development programs, production expansion programs and market studies. Many of these programs involved information and technical assistance provided by the Mineral Development Division of the Department of Mines and Energy.

INDUSTRY ACTIVITIES

The following are highlights related to industry activity in industrial minerals during 1984.

AGGREGATE

Aggregate production remained steady during the year with production volumes expected to be up slightly for 1983. Exports have increased substantially over previous years, attributed to shipments to the southern United States and Prince Edward Island by **Construction Aggregates Ltd.** at Mulgrave, Guysborough County and by **Permanent Concrete Ltd.** at Folly Lake, Cumberland County who shipped aggregate materials to Prince Edward Island and railway ballast to New Brunswick and Quebec.

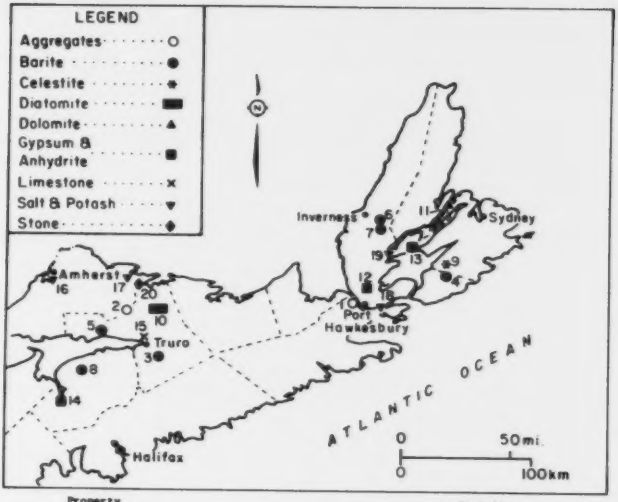
BARITE

Brookfield

Nystone Chemicals continued operation of their barite quarry at Brookfield, Colchester County and their plant at Debert, Colchester County. Along with their established pharmaceutical barite production, Nystone began the production of drilling mud grade barite. All ore was crushed and jigged at the mine site.

Loch Lomond Region

Bovex Mining and Exploration operated their mine at Lake Uist, Richmond County and flotation concentrating mill at Enon, Cape Breton County. Total production is shipped for use in offshore drilling.



	Property	Activity
1.	Construction Aggregates Ltd.	aggregate exports to U.S.A.
2.	Permanent Concrete Ltd.	aggregate exports to several Eastern Canadian markets
3.	Bystone Chemicals Ltd.	drill mud barite production
4.	Hovex Mining and Exploration	drill mud barite production
5.	Magcobar Canada	drill mud barite production
6.	Scotaville Mineral Resources	open-pit mine development
7.	Conwest	mine feasibility study
8.	Magcobar Canada	barite reclamation study
9.	Nova Scotia Department of Mines and Energy	development tenders called for MacRae celestite deposit
10.	Crossman	sample and assay work
11.	Scotia Limestone	quarry development
12.	Georgia Pacific	quarry development
13.	Little Narrows Gypsum	road construction to new deposit
14.	Domtar Construction Materials	manufacturing a new gypsum product
15.	Canada Cement	diamond-drilling program
16.	Sifto Salt	plant modernization
17.	Canadian Salt	Provincial highway upgrading to improve truck transportation
18.	Gulf Canada	exploration licences and underground gas storage permit issued
19.	Noranda Exploration	potash exploration licence
20.	Wallace Quarries Ltd.	feasibility study

Figure 1. Industrial mineral activities in Nova Scotia in 1984.

Bass River

In northern Nova Scotia, **Magcobar Division, Dresser Canada Inc.** operated a small, run of mine drill mud grade barite deposit at Upper Bass River, Colchester County. The ore was shipped to Walton, Hants County for final grinding.

Scotsville

At Scotsville, Inverness County, **Scotsville Mineral Resources** completed a diamond drilling program and a mine feasibility study on the MacInnis barite deposit. Presently mine development is underway with production slated for late 1984.

Trout River

Conwest, owners of the barite-fluorite deposits at Trout River, Inverness County continued work on market and mine feasibility studies on the Johnson vein.

Walton

At Walton, Hants County, **Magcobar Dresser Canada** has completed an evaluation program of barite reclamation from the Walton mine waste dumps. Magcobar has been issued a Special Mining Lease to commence this program when markets dictate.

CELESTITE

In September 1984 the Nova Scotia Department of Mines and Energy invited development proposals using the MacRae celestite deposit at Enon, Cape Breton County. This deposit, which was a former open-pit producing mine operated by **Kaiser Celestite Mining Ltd.,** contains over 800,000 tons of celestite ore.

DIATOMITE

In 1983 there was a renewed interest in the Province's diatomaceous earth deposits. Numerous occurrences are known in the Cobequid Mountain region of northern Nova Scotia and along the North Mountain region of Annapolis and Digby Counties. Although no production ensued, deposits in the New Annan district of Colchester County were sampled and assayed for use as a filler and as a pozzolan.

DOLOMITE

Development work began late in the year on the **Scotia Limestone** dolomite deposit at Kellys Cove, Victoria County. Nova Construction has been contracted to quarry and crush the stone for Scotia Limestone. The stone will then be shipped to the steel plant in Sydney.

GYPSUM AND ANHYDRITE

Two companies began development programs on new gypsum reserves and a third company began the production and marketing of a new gypsum product.

At Sugar Camp, Inverness County (7 miles north of Port Hawkesbury) **Georgia Pacific** began development on a new gypsum property. At Little Narrows, Victoria County, **Little Narrows Gypsum** continued their program to develop a new deposit to the northeast of the present quarry.

At Windsor, Hants County, **Domtar**, which operates the only gypsum processing plant in the Province, began manufacturing gyp-crete, a gypsum-cement product used mostly for flooring in large commercial buildings.

LIMESTONE

Canada Cement has been exploring for high calcium limestone deposits in the central and northern mainland regions of the Province. Late in the year a diamond drilling program was started on known limestone occurrences at Upper Brookside and East Mountain, Colchester County.

SALT AND POTASH

Salt production in Nova Scotia has been dropping in recent years, attributed to competition from new production in other Eastern Canadian Provinces, imports of Spanish solar salt used primarily in the fishery and a change in user specifications.

On a more optimistic note **Sifto Salt**, with Federal assistance provided through an Atlantic Energy Conservation Investment Program (AECIP) grant, have announced an $8 million program to modernize their plant. The Provincial government and **The Canadian Salt Company** have signed an agreement to upgrade a highway leading from Pugwash to the Trans-Canada Highway allowing the salt company to increase the weight of truck shipments.

Gulf Canada Ltd. was issued a salt and potash exploration licence and an underground gas storage permit in the McIntyre Lake area of Inverness County and **Noranda Exploration** continued to hold their special licence for potash exploration in the Ashfield, Inverness County area.

STONE

Throughout the year interest in building stone increased for use in new building projects and in the possibility of obtaining stone from defunct quarries. In response to several inquiries into the availability of sandstone for restoration work in the Halifax area and the Northeastern United States, a feasibility study for reopening the Wallace quarries was commissioned by the company **Wallace Quarries Ltd.**

INDUSTRIAL MINERAL ACTIVITIES, MINERAL DEVELOPMENT DIVISION

Along with the usual duties of the industrial minerals geologist the following projects were undertaken.

a. Aggregate resource studies* were completed for Cape Breton Island and southwestern Nova Scotia with final reports nearing completion.

b. A gypsum deposit study** for the Province was started under the student summer works program.

c. A report on the Cretaceous clay and silica sand deposits of the Province* is nearing completion.

d. A new edition of the Provincial industrial minerals map** at a scale of 1:500,000 is in progress with publication slated early 1985.

e. Publications and papers presented include:

(a) *Industrial Minerals of Nova Scotia* in the May 1984 issue of Industrial Minerals magazine.

(b) *Cretaceous Clay and Sand Deposits in Central Nova Scotia* in the Geology of Industrial Minerals in Canada, Canadian Institute of Mining and Metallurgy, Special Volume 29, 1984.

(c) *Barytes, The No Weight Agent*, a paper presented at the annual meeting of the Mining Society of Nova Scotia, Ingonish, June 28, 1984.

CANADA-NOVA SCOTIA MINERAL DEVELOPMENT AGREEMENT

Industrial minerals have always played an important role in the economy of Nova Scotia and will continue to do so in the future. The recent signing of the Canada-Nova Scotia Mineral Development Agreement means that close to $5 million will be directed towards industrial mineral programs over the next five year period. Mineral Policy Sector and CANMET along with Nova Scotia Department of Mines and Energy will be involved with geological, marketing and technical research programs designed to stimulate new mineral development and increase productivity. Commodities receiving attention include aggregates, baryte-fluorite, building stone, fillers, gypsum and anhydrite, lightweight aggregate material, celestite, borates, brucite, spodumene, wollastonite, diatomite, fly ash, potash, salt and silica sand.

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*Canada-Nova Scotia Co-operative Mineral Program 1981-84
Canada-Nova Scotia Mineral Development Agreement
Mainly funded by Province of Nova Scotia

**Canada-Nova Scotia Mineral Development Agreement
Funded by Province of Nova Scotia

MINERAL INVENTORY

M. A. Lyttle

GEOSCAN ACTIVITIES

Indexing and on-line data entry into GEOSCAN, the national, bibliographic database for geological information, have continued throughout 1984 for Nova Scotia Department of Mines and Energy assessment reports, publications, open file reports and open file maps, and geoscience theses and journal literature. As of December 31, 1984, the database contained 7,013 Nova Scotia Department of Mines and Energy records, consisting of: 3,454 assessment reports; 1,520 publications; 978 journal literature references; 535 open file reports; 507 theses; and 20 open file maps. *Report 84-2 Index to Assessment Reports 1983 (with Keyword Index), Report 84-3 Index to Publications and Open File Reports 1981, 1982 and 1983 (with Keyword Index),* and *Report 84-4 Keyword Index to Theses in Report 81-6* were released in July 1984.

GEOSCAN Petroleum Exploration Assessment Reports Project** (M. J. Fraser-MacKinnon)

This project started in May 1984, and as of December 31, 1984, 343 petroleum exploration assessment reports had been indexed, consisting of 92 onshore reports and 251 offshore reports acquired between 1968 and 1984. Of these 343 petroleum exploration assessment reports, 111 are publically available (i.e. nonconfidential), consisting of 20 onshore reports and 91 offshore reports. The 232 confidential reports consist of 72 onshore reports and 160 offshore reports.

GEOSCAN Theses Project*** (D. B. Hopper)

This project, completed in April 1984, has been responsible for the identification and indexing of 507 B.Sc., M.Sc. and Ph.D. theses on various aspects of the geoscience of Nova Scotia, available up to the end of 1980. An author index and an NTS index to these theses were published in *Report 81-6 Index to Publications, Open File Reports and Theses, 1862-1980. Report 84-3 Keyword Index to Theses in Report 81-6* was published in July 1984. A publically accessible microfilm file of 430 of these theses is available for consultation in the Halifax Library of the Nova Scotia Department of Mines and Energy, and a Theses Location Map is under preparation.

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*Canada-Nova Scotia Co-opertive Mineral Program 1981-84 and
Canada-Nova Scotia Mineral Development Agreement
Funded by Province of Nova Scotia and Energy, Mines and Resources Canada
**Canada-Nova Scotia Mineral Development Agreement
Funded by Province of Nova Scotia
***Canada-Nova Scotia Co-operative Mineral Program 1981-84
Funded by Energy, Mines and Resources Canada

GEOSCAN Journal Literature Project (G. Frotten)**

This project started in January 1984, and as of December 31, 1984 1,674 journal literature references on the geoscience of Nova Scotia had been identified. Of these 1,674 references, 978 have been entered into GEOSCAN. Author, NTS and keyword indexes to geoscience journal literature references on Nova Scotia will be published once reference acquisition, indexing and data entry are completed.

GEOSCAN Records Standardization Project (D. Wilkinson)**

Participating agencies have been converting and standardizing their GEOSCAN records to facilitate compatibility and searching of the database as part of the preparations involved in making GEOSCAN publically accessible through commercial on-line database vendors. The conversion and standardization of Nova Scotia GEOSCAN records started in January 1984, and as of December 31, 1984, 3,362 records had been processed. A backlog of 1,113 records remains to be standardized.

GEOSCAN Data Entry Project (J. Newman)**

In order to keep on-line data entry into GEOSCAN up to date with the volume of indexed code sheets generated by the various GEOSCAN projects funded under the Federal-Provincial Agreements, a full-time data entry operator was hired, and started in January 1984. As of December 31, 1984, 361 assessment reports, 134 publications, 30 open file reports, 20 open file maps, 129 theses, 435 journal literature references and 2,973 converted records had been added to the database. The present backlog of documents awaiting data entry is 91 journal literature references, and 856 converted records.

GOLD BIBLIOGRAPHY (J. Gillespie-Wood)

Compilation of information for the gold bibliography, to be entitled *Gold in Nova Scotia: a Bibliography of the Geology, and Exploration and Mining Histories from 1829 to 1984*, is well advanced, and publication is expected early in 1985. The bibliography will contain approximately 1,250 references, covering approximately 265 documented gold districts and occurrences. The bibliography will be organized into three parts: Part I will consist of the following cross reference lists - gold district/occurrence / NTS map / county, NTS map / gold district/occurrence/ county, and county / gold district/occurrence / NTS map; Part II will be an alphabetic author index; and Part III will be an index by gold district, with each gold district subdivided into an author index, an assessment report index and a map and section index.

GOLD PAMPHLET (J. Bates)**

In co-operation with the Public Awareness section, a pamphlet entitled *Gold in Nova Scotia* has been written, and is in the final stages of preparation. The pamphlet is written in a nontechnical manner, intended for the general public and school students. The pamphlet contains information on the history of gold mining in Nova Scotia; the mining and extraction of gold; the occurrence and distribution of gold in Nova Scotia;

the geology and origin of gold deposits in Nova Scotia; and present and future trends in gold exploration. In addition, the pamphlet contains production figures by region; an additional Information/Do-It-Yourself section; a listing of gold festivals and related events; a listing of related continuing education courses on introductory geology and prospecting; and a listing of selected references.

MINERAL OCCURRENCES DATABASE PROJECT* (M. Ponsford)

Information from the metallic mineral occurrences data card file and the industrial mineral occurrences data card file have been computerized to form two mineral occurrences databases. The metallic mineral occurrences database consists of information on 894 mineral occurrences that is recorded in 27 data fields. The industrial mineral occurrences database consists of information on 1,042 mineral occurrences that is recorded in 20 data fields. The databases can be searched on individual data fields or any combination of data fields, and the search results printed out at a computer terminal. In addition, map plots of mineral occurrence locations, at any requested scale, can also be obtained. At present, the mineral occurrences databases are supported at the Maritime Resource Management Service (MRMS) in Amherst, where they can be accessed on a fee-for-service basis.

The metallic mineral occurrences database has been updated with new information from documents covering the period 1978, 1979, and 1980. All the mineral occurrences have been plotted on a set of three, 1:250,000 geological base maps, covering Nova Scotia. These maps together with the full 27 field computer listings for each map sheet, were released in December 1984 as open file reports 599, 600 and 601. OFR 599 consists of maps 11D and 11E; OFR 600 consists of maps 11F, 11G, 11J, 11K and 11N; and OFR 601 consists of maps 20O, 20P, 21A, 21B and 21H. Work has begun on updating the industrial mineral occurrences database to 1980, and when complete, a similar set of new open file reports will be released.

DRILLHOLE DATABASE PROJECT* (G. Demont)

As of December 31, 1984 all the assessment reports cited in *Report 81-7 Index to Drillhole and Well Data 1862-1980* had been coded for the information required for the 26 data fields which constitute the original drillhole database. This represents approximately 8,200 drillholes from 1,496 assessment reports. Drillhole data for the following maps sheets have now been entered into the database: 11D, 11E, and 11F. Data for maps 11G, 11J, 11K, 11N, 20O, 20P, 21A, 21B and 21H have still to be entered into the database.

In response to requests for additional drillhole information, six new fields were added to the database during the summer of 1984, namely: drillhole locality, drillhole dip, overburden thickness, Nova Scotia Department of Mines and Energy drillhole record number, exploration company, and drillhole sample location. Data for these additional fields have been coded for all map sheets but entered into the database only for drillholes on map sheet 11D. The data for overburden thickness are available in manual form for all 8,200 drillholes.

The database can be searched on individual data fields or any combination of data fields, and the search results printed out at a computer terminal. In addition, map plots of drillhole locations, at any requested scale, can also be obtained. At present, the drillhole database is supported at the Maritime Resource Management Service, where it can be accessed on a fee-for-service basis.

EXPLORATION EXPENDITURE DATA COMPILATION

R. Ratcliffe

A geographer hired this summer under the Provincial Summer Employment Program completed a series of five maps representing exploration expenditures reported* to the Department of Mines and Energy for the years 1979 to 1983 inclusive. The maps are comprised of proportional circles located in the geographic centres of the exploration programs. Each proportional circle, which represents the amount of expenditure reported by licensees, was then classified by commodity sought (Fig. 1). The result is a series of maps which provides the emphasis of exploration expenditures in a given year at a glance. When viewed as a map set, a change in this emphasis is seen through time.

These maps are available in the Halifax office of the Nova Scotia Department of Mines and Energy at either page size or at a scale of 1:1,000,000.

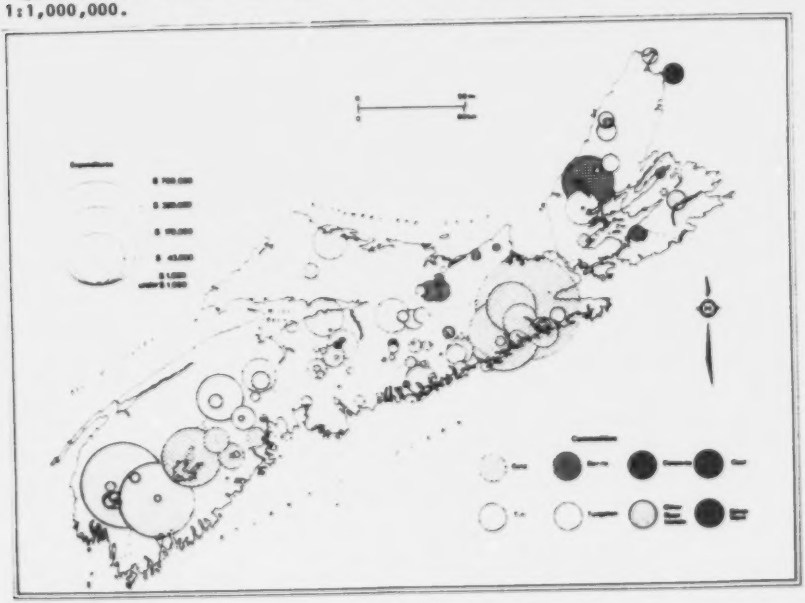


Figure 1. Map of expenditures and commodities for work reported in Nova Scotia (Jan. 1-Dec. 31, 1983).

*Submitted to Nova Scotia Department of Mines and Energy for assessment credits and does not represent all work carried out during the year or work necessarily done within reporting year.

MINERAL AND ENERGY LAND USE PLANNING PROJECT*

D. B. Hopper

In June 1983 a new Planning Act for Nova Scotia was ratified by the Legislature. The Act enables the Province to prepare Provincial land use policies whose intent shall be embodied within planning strategies at the municipal level. The Nova Scotia Department of Mines and Energy recognizes its obligations in forming Provincial land use policies to provide responsible management and protection of the Province's mineral and energy resources.

Under the new Canada-Nova Scotia Mineral Development Agreement the Department has initiated a land use planning project to expedite the formulation of a mineral land use policy for Nova Scotia.

The Department's main aim is to ensure the protection, conservation and proper management of the Province's earth resources. Specific objectives are as follows:

- To identify planning issues associated with mineral and energy resource lands in Nova Scotia.
- To provide general direction and information on mineral and energy resources in an appropriate form to facilitate land use decision making.
- To ensure that the Province's mineral and energy resources are available for exploration and development in the present and future.
- To provide for the full consideration of mineral assessment in land use planning and proposed designation of surface lands.
- To provide maps of mineral potential for the Province.

The project will be carried out in three phases over a five year period. Each phase will provide the necessary foundation for a Provincial mineral land use policy.

PHASE ONE: INFORMATION BASE

A systematic collection of existing geoscientific and industry related information is currently in progress. This will be organized according to the Province's twenty-four municipal districts. As a result, each municipal planning district will gain a Mines and Energy Information package complete with a set of 1:50,000 maps.

The information package will consist of Mineral Inventory data, bibliographies, mineral and energy exploration and development statistics,

*Canada-Nova Scotia Mineral Development Agreement
Funded by Province of Nova Scotia

past and present mine and quarry plans, case histories of land use conflicts relating to mineral and energy land use, and listings of contacts within the Department.

Mineral resource land use maps will show the distribution of mineral and energy resources within each municipal district; as well as sand and gravel occurrences and other surficial deposits; abandoned mine workings; diamond-drill hole and petroleum well locations; mines, quarries and borrow pits locations.

PHASE TWO: MINERAL POTENTIAL MAPS

Mineral potential maps will be compiled from data collected in phase one. These will be designed for those with little or no specialized knowledge in geoscience. A simple rating scheme, will be provided to evaluate the mineral exploration and development potential of the Province.

PHASE THREE: A MINERAL LAND USE POLICY

With a comprehensive mineral and energy land use information data base in place and mineral potential maps produced, Provincial land use policies can be formulated.

The Department's primary concern is to provide geological information to facilitate the development of the mineral and energy industry in Nova Scotia. The range of concern, however, includes furnishing Provincial and regional planners with useful, current information. Moreover it is in the Province's best interest to encourage the use of basic geological information in the planning process.

DRILL CORE LIBRARY

J. D. Langille and J. M. Bingley

The Department of Mines and Energy maintains core storage facilities at four locations in a total of six buildings. The main facility is in the Stellarton Industrial Park (Fig. 1) and consists of three buildings each having a floor area of approximately 8,000 square feet (745 m^2). All cores in these buildings are on pallets and may be moved by fork lift to a central laboratory for examination. Saws, splitters and an ultraviolet lamp are available for use at this central laboratory. Total core in storage now exceeds 820,000 feet (250 000 m).

The other core storage facilities are at the Department of Mines and Energy office building on Bridge Avenue in Stellarton, in the Debert Air Industrial Park and at Malagawatch, Inverness County.

Cataloguing of information related to each drill core is ongoing, but due to priority being placed on acquisition of new cores (Table 1), only a preliminary listing is available to date.

Anyone wishing to examine core in any of these facilities please contact either John McMullin, Jim Langille or Dennis Murphy at (902) 752-8429 to ensure that a staff member is available to give assistance.

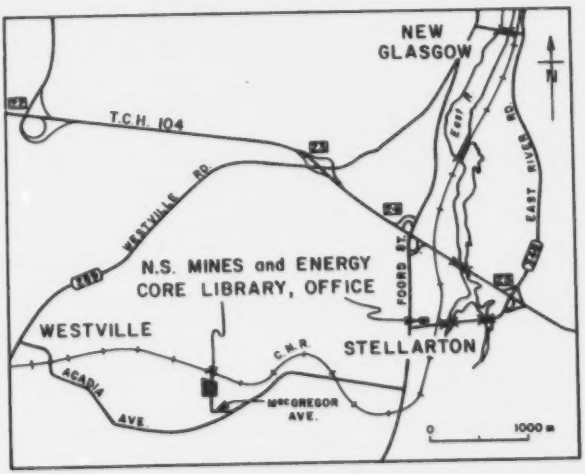


Figure 1. Location of the Nova Scotia Department of Mines and Energy core library and Stellarton office.

Table 1. Drill core acquisitions in Departmental core libraries for 1983-1984 (to October 1, 1984)

STELLARTON CORE LIBRARY

Company or Group	Location of Drilling	Amount (m)
Nova Scotia Department of Mines and Energy		
Coal Inventory	Springhill, Cumberland County	1 284
	Roslin, Cumberland County	128
	Donkin, Cape Breton County	346
	St. Rose, Inverness County	1 367
	Thorburn, Pictou County	30
Carboniferous Stratigraphic Study	Point Edward, Cape Breton County	761
	Kempt Head, Victoria County	946
	Woodbine Road, Cape Breton County	772
Stratigraphic/Petrographic Study	College Grant, Guysborough County	686
Amax of Canada Limited	Oxford, Cumberland County; and Framboise, Cape Breton County	2 034
Atlantic Gold Mines Limited and Chib-Kayrand Copper Mines Limited	Ecum Secum, Guysborough County; Killag Lake, Halifax County; Miller Lake, Guysborough County; and Mount Uniacke, Hants County	853
Billiton Canada Limited	Caledonia, Queens County	640
	Ship Harbour, Halifax County	709
Borcan Resources Limited	Renfrew, Hants County	695
Brascan Limited	Limehill, Inverness County	1 074
Campbell Resources Incorporated	Scotsville, Inverness County	597
Cuvier Mines Incorporated/ MEX Explorations Limited	Five Islands and Londonderry, Colchester County; Pine Brook, Cape Breton County; and Whycocomagh Mountain, Inverness County	4 227
Esso Resources Canada Limited	Pearl Lake, Yarmouth County	2 077
Getty Mines Limited	Gays River, Halifax County; and Middle River, Victoria County	17 556

Table 1. Continued.

Company or Group	Location of Drilling	Amount (m)
Granges Exploration AB	Smithfield, Colchester County	2 469
International Geochemical Associates Limited and Entrepreneurial Management Limited	Mile Lake (Forest Hill), Guysborough County	221
Nolan Davis and Associates Limited	Various "soil testing holes", Province wide	206
Northumberland Mines Limited	Cochrane Hill, Guysborough County	8 032
Novaco Limited	Point Aconi, Cape Breton County	329
Novacorp Engineering Services Limited/Noval Technologies/ Algas Resources	Glengarry, Cape Breton County; Inverness and Port Hood, Inverness County; Maccan and Springhill, Cumberland County; and Stellarton, Pictou County	5 317
Onitap Resources	Goldboro, Guysborough County	529
Outland Resources Corporation	Widow Point, Guysborough County (Core) (Auger)	381 191
Paragon Explorations Limited	Country Harbour, Guysborough County	821
Pictou Energy Limited	Westville, Pictou County	244
Rio Algom Exploration Limited	Henry Lake/Long Lake, Lunenburg County	619
Scotia Limestone Limited	Scotch Lake, Cape Breton County	241
Shell Canada Resources Limited	Yarmouth County Noel Lake, Hants County	11 563 652
St. Joe Canada Incorporated/ Sulpetro Minerals Limited	Wire Lake, Halifax County Salmon River (Dufferin Mines), Halifax County Sarach Brook, Victoria County	222 228 184
Suncor Incorporated	Stellarton/New Glasgow, Pictou County	2 089
Whiteburn Precious Metals Limited	Whiteburn, Queens County	457
	TOTAL	71 777
		235,489 Feet

REGIONAL GEOCHEMICAL SURVEYS*

P. J. Rogers and M. A. MacDonald

POST 1982 DATABASE AND DATA PROCESSING STRUCTURE FOR REGIONAL GEOCHEMICAL DATA

Since 1982 the areas outlined in Figure 1 have been sampled or samples collected from previous surveys were reanalyzed for the various elements indicated. After suitable quality control proceedures the basic data are compiled at the 1:50,000 scale and a preliminary statistical analyses performed. Each UTM sheet has a data series for individual elements with different plot symbols for each sampling medium. All the sample points are digitized and the maps plotted by computer.

After the basic data have been released compilation at the 1:250,000 scale will continue with 3 sheets for the Province, western, central and eastern (Fig. 1). The processing structure for publication is illustrated in Figure 2.

LITHOPHILE ELEMENTS AND EXPLORATION USING CENTRE-LAKE BOTTOM SEDIMENTS FROM THE EAST KEMPTVILLE AREA

In 1977 and 1978, southern Nova Scotia was covered by a regional centre-lake bottom sediment survey funded by the 1975-80 Canada Department of Regional Economic Expansion - Nova Scotia (DREE-NS) Mineral Development Agreement (Bingley and Richardson, 1978; and Richardson and Bingley, 1980). The methods used were those of the National Geochemical Reconnaissance (NGR) Program of the Geological Survey of Canada. Detailed lithogeochemical studies on drill core from East Kemptville (Richardson et al., 1982) have demonstrated significant roles for the elements Zn-Cu-Th-Li-F-Sn-U-Rb in the hydrothermal mineralization (Chatterjee and Strong, 1984). Most of these significant mineralizing elements were not analyzed as part of the routine NGR suite of Cu-Pb-Zn-Ag-Ni-Co-Fe-Mn-Ca-Mg-Mo-Hg-As-U-LOI.

To test the applicability of using these lithophile elements in regional centre-lake bottom sediment geochemical programs, a subset of 55 lake sediment samples were analyzed by X-ray (XRF) fluoresence for Rb and Sn; colorimetrically for Cl, and Specific Ion Electrode for F. The detailed till sampling at East Kemptville for Sn, W, Cu and Zn provides a control to the probable source of the material found in the centre-lake bottom sediments (Wilson and Richardson, 1980).

In the data subset from the East Kemptville area of 55 samples, Sn values were found in the range from 1 to 32 ppm, Rb from 10 to 207 ppm, F from 25 to 410 ppm and Cl from 240 to 1660 ppm. All of the anomalous values of F, Rb and Sn form a distinct halo of elevated levels around the East Kemptville deposit. The deposit appears to lie in an area of

*Canada-Nova Scotia Co-operative Mineral Program 1981-84.
Canada-Nova Scotia Mineral Development Agreement.
Mainly funded by Energy, Mines and Resources Canada.

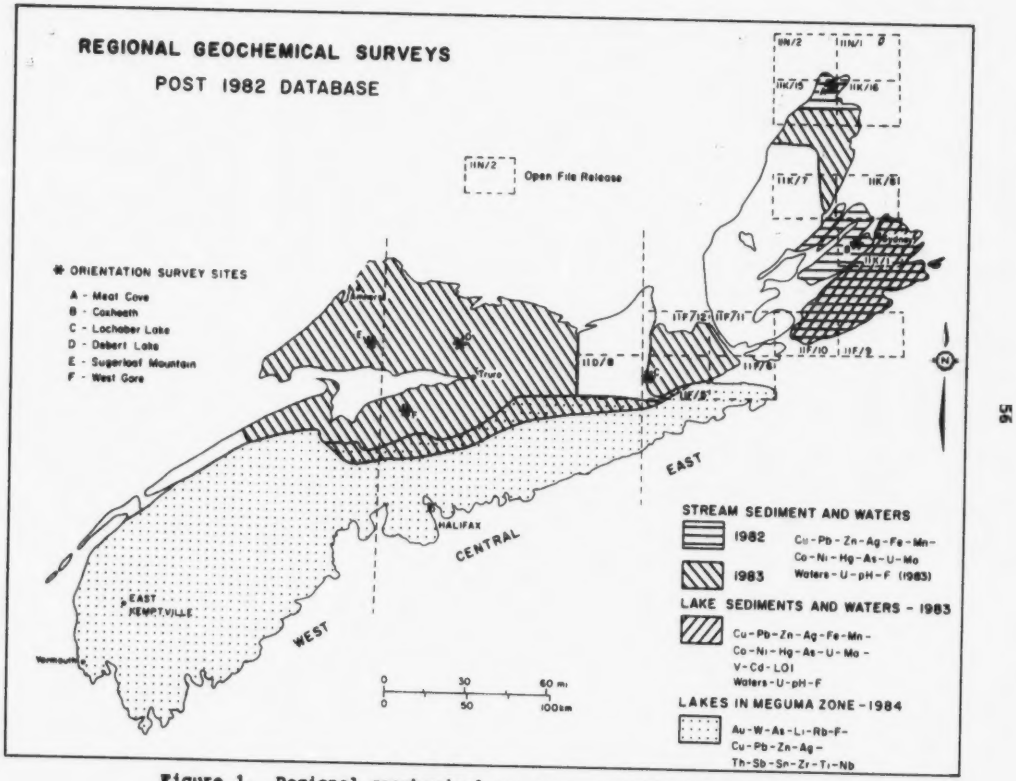


Figure 1. Regional geochemical surveys post 1982 database.

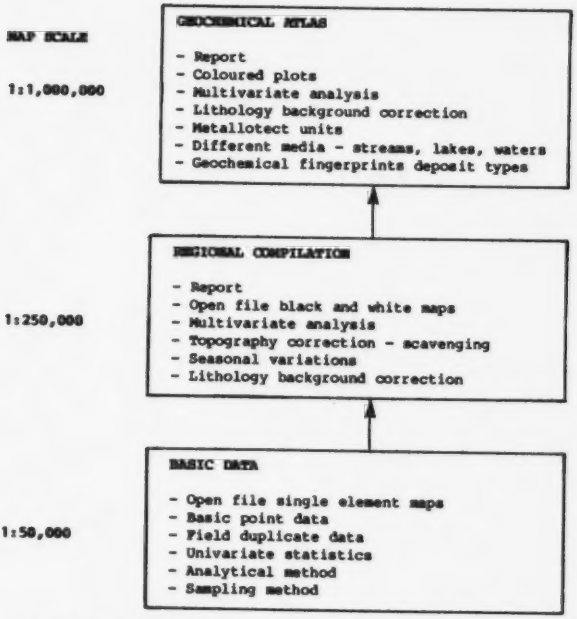


Figure 2. Geochemical data analyses and processing structure for publication of results.

depressed (background) values surrounded by a halo of higher values which occurs southwest, southeast and northeast of the deposit (Fig. 3).

The Sn, F and Rb highs are centred around Moosefly Lake, approximately 5.6 miles (9 km) to the southeast of the deposit with a tail of elevated values stretching as far as 11.2 miles (18 km) to the southeast. The Cl pattern is markedly different. It forms a high to the northeast of the deposit and appears to be more proximal to the granite/sediment contact. The U values, however, also seem to be more proximal to the granitoid rocks with a high of 227 ppm around the Davis Lake area. The anomalous tail to the southeast of East Kemptville and towards the Moosefly Lake area is also present in the U plots.

Correlation co-efficients at the 99.9 confidence interval computed for the East Kemptville lake sediment data subset show strong core relationships between As, Co, Mn, Mg, and Fe; Cu and Zn; and Cu and U. Sn, F and Rb are positively correlated, but do not have any significant relationships with the other elements. There is no significant correlation between Sn, Rb, F or the organic content (as LOI) (Fig. 4).

Regional till mapping in the area (Stea and Grant, 1982) indicates a polyphase glacial history with numerous ice advances. An early

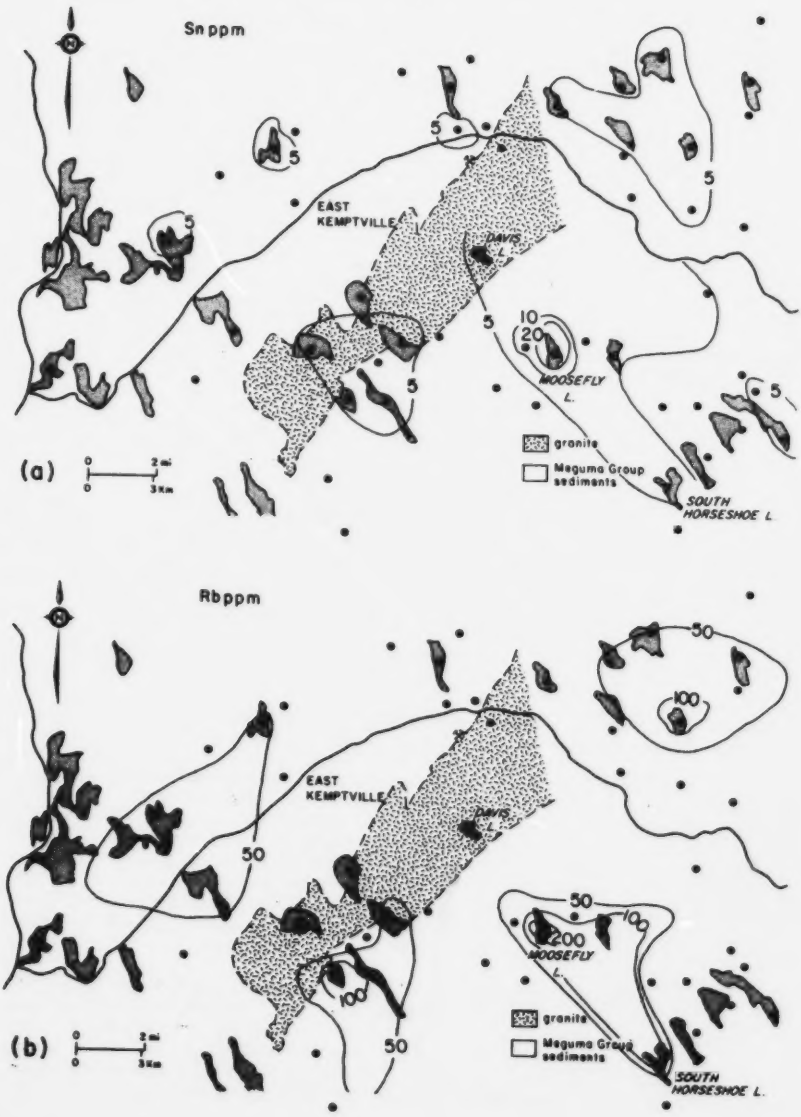
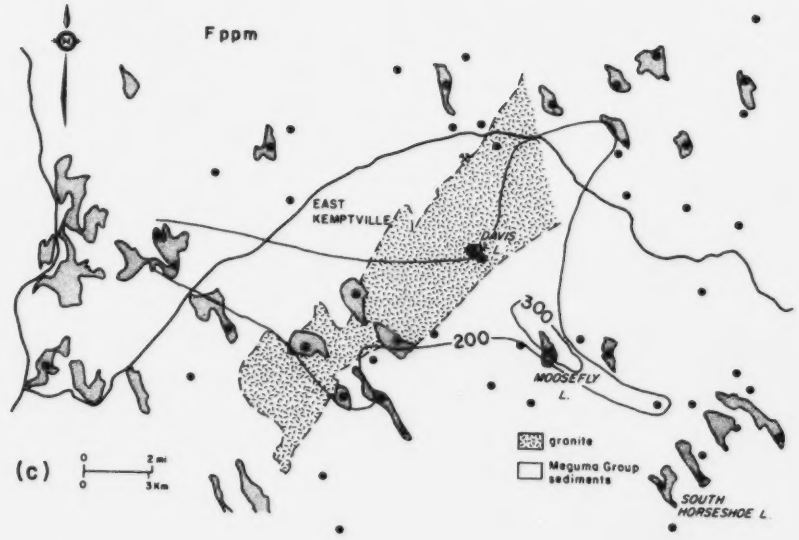


Figure 3. Hand contoured plots of centre lake bottom sediments around the East Kemptville tin deposit (3a. Sn; 3b. Rb; 3c. F; 3d. Cl; 3e. U).



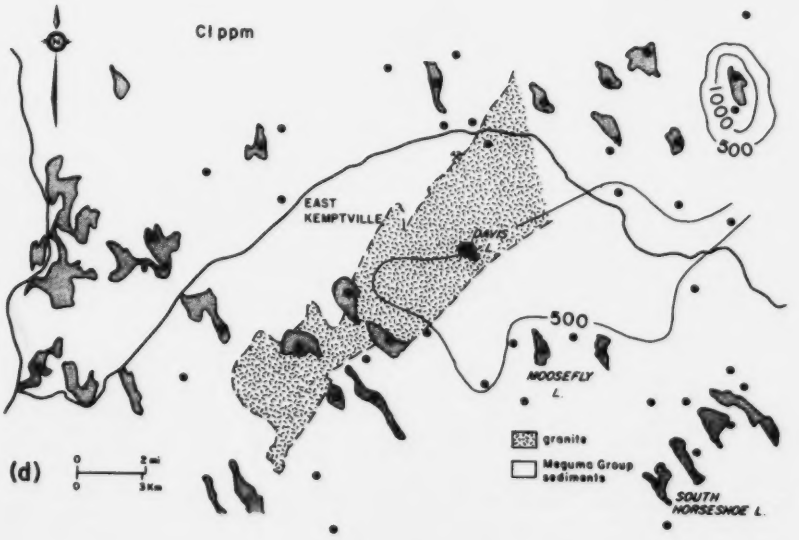


Figure 3. Continued.

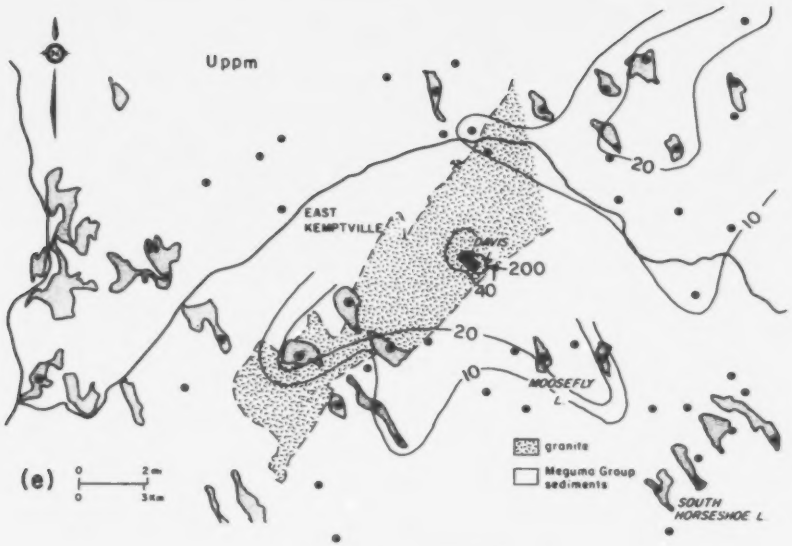


Figure 3. Continued.

southeastward regional advance formed extensive drumlin fields and the present lake morphology appears to align itself to parallel this principal drumlin directional axis. This southeastward regional advance is probably that preserved in the pronounced tail of Sn, F, Rb and U found in the lake sediments. Other more local advances are preserved as striae with both southerly and southwesterly components. Both of these directions are probably represented in the lake sediments by the halo pattern of higher values of Sn, F, Rb and to a lesser extent U. Detailed follow-up till studies at East Kemptville indicate a strong southerly displacement especially for W (Wilson and Richardson, 1980). The W anomalies are grouped in one main area over the granite. The Sn in till also has a limited southeasterly dispersal onto the surrounding sediments towards the Moosefly Lake area.

The relationship between the lake, its drainage catchment area and anomalous metal content is considered in Figure 5. Each lake basin catchment area with anomalous Sn or Rb is highlighted. The patterns of Sn and Rb anomalies are not obviously related to the overall drainage pattern. Each anomalous lake has its own discrete character and is isolated within the drainage system. This would seem to indicate a point source of anomalous metal close to the lake and that once entered into an individual lake little further movement of anomalous mineral phases takes place out into the basin's drainage system. The anomaly in a lake is thus

derived from a very local (till) input and indicates that follow-up investigations at a particular lake should begin to pin-point this source input.

The main mineralization of economic interest at East Kemptville is chalcopyrite, sphalerite, cassiterite and wolframite, both the latter two minerals contributing to the Sn and W till anomalies. Heavy minerals from a bulk sample at Moosefly Lake (the same site as the 32 ppm Sn value from the regional survey subset of samples) were obtained using methylene iodide. Analysis with the spot analyzer of a Scanning Electron Microscope indicates the presence of discrete grains of cassiterite in the centre-lake bottom sediment. A clean, sharp, angular cassiterite grain was found in addition to numerous grains of zircon, monazite and magnetite (Fig. 6).

The high Sn anomaly in the centre-lake bottom sediment is thus probably due, at least in part, to the presence of discrete cassiterite grains. The lack of abrasion would seem to indicate derivation from the nearby known cassiterite-rich tills. The lack of correlation with organic material (as LOI) and the other NGR suite elements indicates the probable dominance of mechanical over chemical dispersion processes producing the Sn anomaly. Evidence from considering the total element suite indicates that F, Cl and Rb are more likely to be associated with clay or silt size particles through adsorbtion onto their surfaces.

Cassiterite as a refractory mineral phase in the lake sediments from East Kemptville produce the Sn anomaly and the F, Cl and Rb are more likely to be associated with clay or silt particles from the till. In either case it is possible to identify anomalous areas of interest using these lithophile elements in centre-lake bottom sediments. The presence of the Sn anomaly, and confirmation of cassiterite in the centre-bottom organic-rich lake sediments, is evidence that clastic dispersion processes should be taken into account when interpreting lake sediment data. Traditionally, in Canada, a common dispersion model was one of initial glacial clastic dispersion, followed by subsequent hydromorphic dispersion into the lake basins. On the basis of this work, while still recognizing the dominance of hydromorphic processes, it is clear that clastic dispersion models must be considered. The converse of this is that centre-lake bottom surveys may have greater application than previously presumed in the search for lithophile elements commonly dispersed as refractory grains. A sampling density of 1 per 2 square miles (5 km^2) is sufficient to detect an exposed East Kemptville type deposit in southern Nova Scotia. Once defined, a displaced anomaly of this type should be investigated with detailed till profile sampling and mapping to identify principal glacial directions and potential sources.

4a. Data Values In ppm Or pct

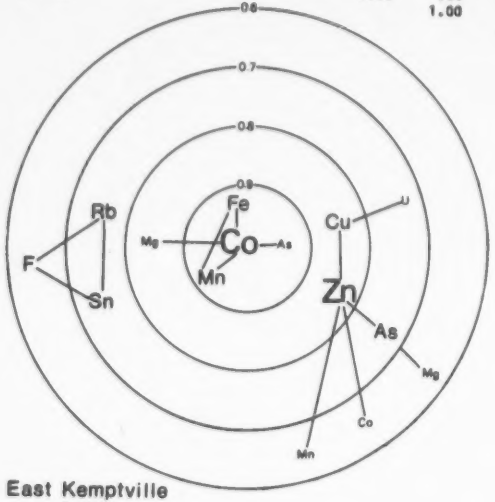
	MEAN	VARIANCE	STD DEV	SKEW	KURTOSIS	MIN	MAX
Sn	4.255	23.971	4.896	3.132	17.276	1.0	32.0
Rb	45.618	1169.870	34.203	2.455	10.864	10.0	207.0
Cu	8.836	43.806	6.619	4.547	28.456	2.0	50.0
Ni	11.658	78.293	8.848	0.221	2.153	1.0	34.4
Pb	10.829	79.655	8.925	3.157	15.660	2.8	57.2
Zn	40.909	3208.418	56.643	3.802	18.110	10.0	340.0
Co	3.422	38.361	6.194	3.350	13.747	1.0	32.0
Fe	0.456	0.260	0.510	2.386	8.166	0.1	2.4
Mn	77.091	11695.084	108.144	2.697	10.398	20.0	560.0
Ca	1279.273	629258.721	793.258	1.127	4.185	340.0	3720.0
Mg	626.545	493867.475	702.757	2.335	8.851	80.0	3640.0
LOI	35.440	226.762	15.059	0.639	2.592	14.2	77.0
Mo	3.244	5.080	2.254	1.531	6.230	1.0	12.0
Hg	0.419	0.019	0.139	0.012	2.671	0.1	0.7
U	15.347	973.030	31.193	5.854	40.034	0.6	227.0
As	5.353	71.959	8.483	3.284	14.214	0.5	43.6
*F	145.755	5595.730	74.805	1.513	4.302	25.0	410.0
*Cl	446.796	84208.041	41.455	2.979	9.524	240.0	1660.0

n = 55
*n = 49

Figure 4. (a) Basic statistics and (b) correlation matrix for East Kemptville data subset.

4b. Correlation Matrix

Cl	F	Sn	Rb	Cu	Pb	Zn	Co	Fe	Mn	Ca	Mg	LOI	Mo	Hg	U	As	
1.00	.25	-.04	.04	.28	.15	.03	-.19	-.22	-.24	-.16	-.26	.52	.13	.10	.27	-.14	Cl
	1.00	.67	.68	.25	.03	.34	.27	.32	.34	-.08	.25	-.34	-.09	-.12	.27	.25	F
		1.00	.73	-.04	-.13	-.01	.05	.07	.03	-.12	.02	-.30	-.07	-.05	-.03	.02	Sn
			1.00	.04	-.13	.05	.12	.13	.14	-.18	.19	-.30	-.06	-.02	.04	.05	Rb
n = 55				1.00	.40	.83	.29	.23	.26	.14	.16	.28	-.01	.28	.80	.42	Cu
					1.00	.44	.21	.15	.16	.07	-.01	.24	.12	.02	.36	.28	Pb
						1.00	.68	.58	.63	.27	.49	.03	-.02	.31	.58	.76	Sn
							1.00	.90	.95	.40	.81	-.27	.08	.34	-.13	.94	Co
								1.00	.93	.32	.87	-.35	.05	.36	-.14	.81	Fe
									1.00	.42	.88	-.34	.09	.32	-.14	.86	Mn
										1.00	.48	.22	.28	.08	-.16	.33	Ca
											1.00	-.35	.18	.31	-.23	.70	Mg
												1.00	.31	.16	.28	-.21	LOI
													1.00	.25	-.21	.09	Mo
														1.00	.01	.40	Hg
															1.00	.01	U
																1.00	As



East Kemptville Lakes

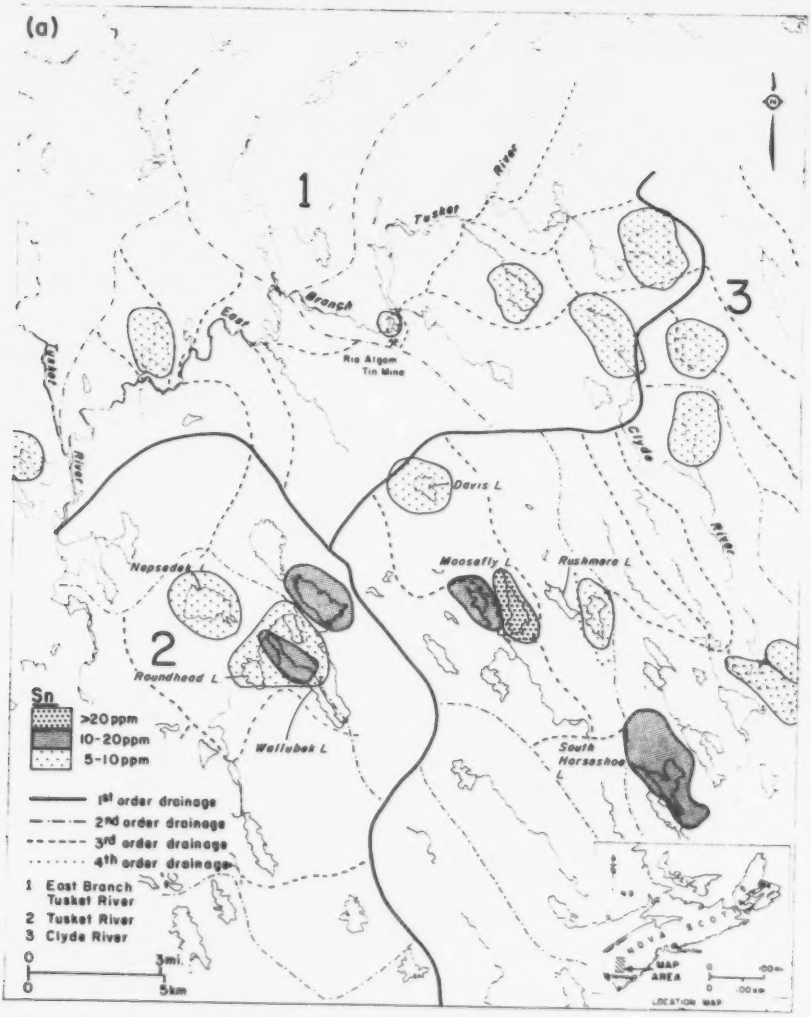
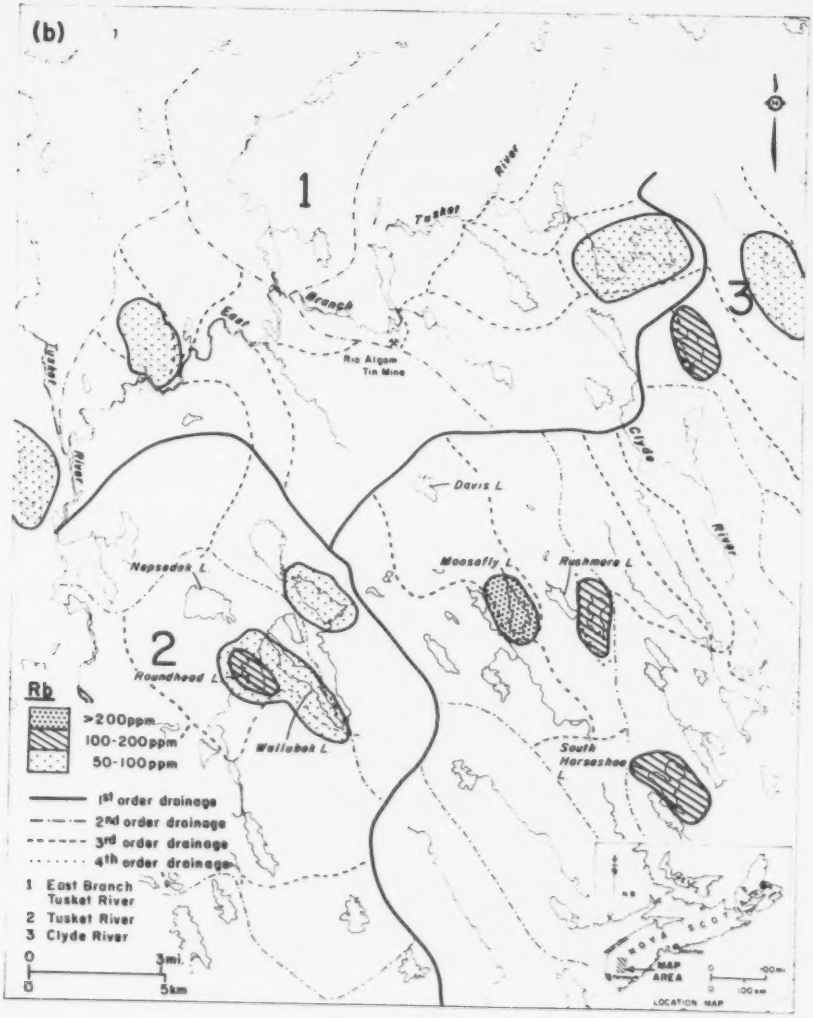


Figure 5. Plots of the relationship of the principal drainage basins for the lakes and anomalous metal content for (a) Sn and (b) Rb around the East Kemptville deposit.



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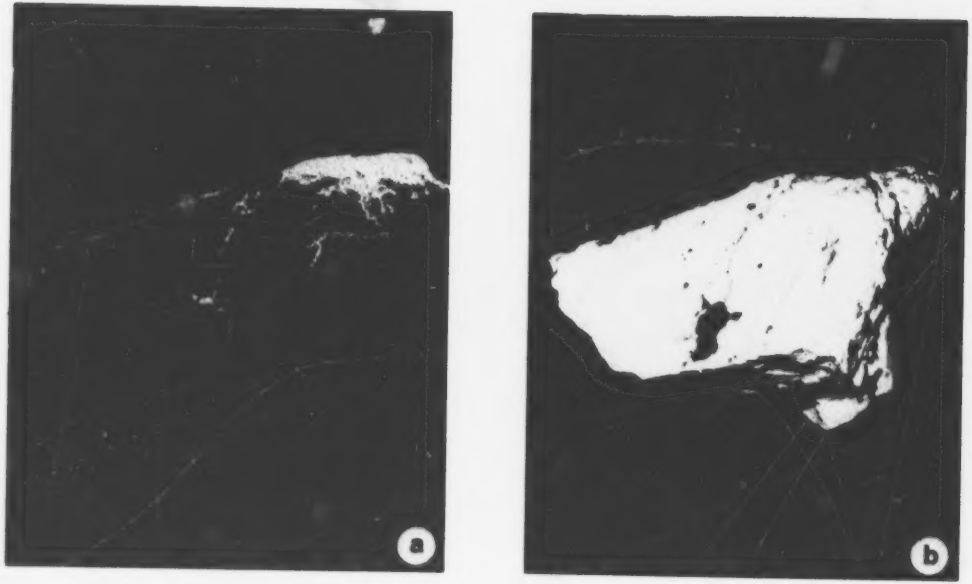

Figure 6. (a) Scanning Electron Microscope photograph of an angular cassiterite grain from the bottom lake sediment at Moosefly Lake. (b) backscatter image; the brightness denotes an element with a high atomic number (Sn = 50).

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A NORTHWARD FLOWING GLACIER IN CUMBERLAND, COLCHESTER AND PICTOU COUNTIES; GEOLOGICAL EVIDENCE AND EFFECTS ON TILL GEOCHEMISTRY*

R. R. Stea and P. W. Finck

ABSTRACT

Erosional and depositional glacial landforms indicate a major northward ice flow crossing the Cobequid Highlands in northern mainland Nova Scotia. Striations trending 001°-020° are found on the fine grained volcanic and metasedimentary rocks of the Cobequid Highlands. Sequences of ice contact stratified drift and outwash indicate northward paleoflow of meltwater streams. Distinctive plutonic and volcanic erratic boulders are dispersed northwards up to 6.2 miles (10 km) from the Cobequids Highlands onto the Carboniferous sedimentary Lowlands. Moraines parallel to the Highlands, and the northward termination of glaciofluvial sequences suggest a stillstand of the northward flowing glacier.

Element levels in the clay fraction of the reddish Lowland till sheet appear to have two controlling influences, provenance and weathering processes. Pb and Zn levels are strongly correlated, with anomalously high values of both elements commonly found in the same samples. Small Pb occurrences associated with grey coaly sandstones and conglomerates, may be the source of these high Pb and Zn values. A secondary influence to Zn levels is the amount of Fe in the till. This is especially significant in sandier tills, where Fe hydroxides form a large proportion of the clay fraction. Ca and Mg levels in the clay fraction of the surface till sheet may be controlled by the interaction of weathering processes and provenance. This study emphasizes the need to recognize till sheets in a mineral exploration program.

INTRODUCTION

This report presents further evidence for a late northward to northeastward ice flow which crossed the Cobequid Highlands and dispersed crystalline and metamorphic erratics over the northern Carboniferous Lowlands. The expression of the northward movement in terms of glacial erosional and depositional features and till geochemistry is also discussed.

The study area includes part of two physiographic regions, the Cumberland-Pictou Lowlands and the Cobequid Highlands (Fig. 1). The Cobequid Highlands are composed of plutonic, volcanic and metasedimentary rocks of Hadrynian to Early Carboniferous age (Donohoe and Wallace, 1978). The Cumberland-Pictou Lowlands are underlain by Early Carboniferous to Triassic age sedimentary rock.

*Canada-Nova Scotia Co-operative Mineral Program 1981-84
Canada-Nova Scotia Mineral Development Agreement
Mainly funded by Energy, Mines and Resources Canada

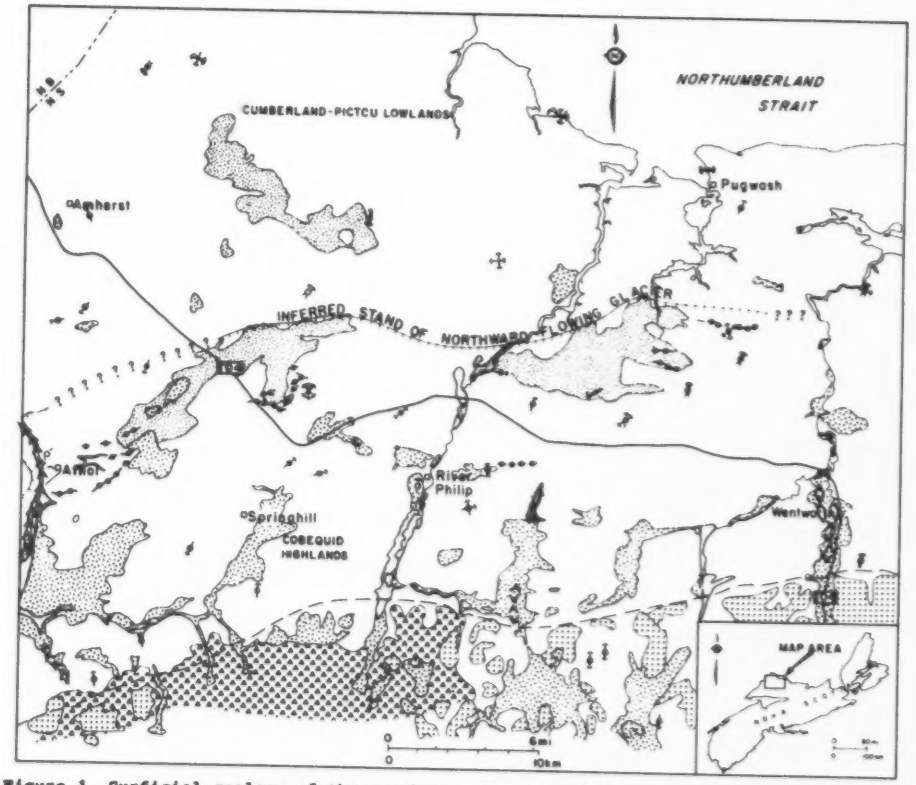

Figure 1. Surficial geology of the northern part of Cumberland and Colchester Counties.

LEGEND

OUTWASH : horizontally bedded, gravelly sand, forming a flat plain.

ICE CONTACT STRATIFIED DRIFT : bedded sand, gravelly sand and boulders, local faulting of strata, forming kame and kettle terrain.

ABLATION TILL : reddish brown, loose, stony, sandy partings and lenses, angular clasts; forming hummocky moraine

TILL : reddish brown, compact, stony, sandy, silt matrix, jointed, composed mainly of Carboniferous sandstone clasts, forming the ground moraine in the Cumberland-Pictou Lowlands

TILL : greyish brown, loose, sandy matrix, composed primarily of Cobequid Highlands plutonic and metamorphic clasts; forming the surface till on the Cobequid Highlands

Note : No stratigraphic order implied

ROCK : areas of barren rock, or thin (< 1m) discontinous till cover.

SYMBOLS

Striations (direction known, unknown, striations from Chalmers (1895)) .....

Esker (direction of flow known, unknown) .....

Moraine .....

Meltwater channel .....

Northward transport of Cobequid Highlands erratics by ice action is not a new concept. Chalmers (1895) mapped northward to northeastward trending striations in the Cumberland-Pictou Lowlands. Poole (1890) and Prest (in Prest et al., 1972) noted the northward transported Cobequid erratics and Grant (1977) advocated a northward ice movement to explain Cobequid erratics near Pictou. Downey (1979), while mapping for Gulf Minerals southeast of Wentworth in the Cobequid Highlands, also described a northward ice flow.

Stea and Finck (1984) mapped and studied the glacial features and till stratigraphy in the study area. Preliminary results revealed a northward transport of Cobequid erratics (found in boulder piles in farmers' fields) onto the Lowlands. Two systematically divergent sets of striations were mapped on the Cobequid Highlands. A regionally consistent striation set trending 170-195° was mapped. The sense of ice movement was determined by northward-facing stoss surfaces and pressure shadows (mini crag and tail features). Striations trending 350° to 035° were also mapped and interpreted using the same criteria. The northward to northeastward trending striations were observed in the Lowland areas on southward facing stoss surfaces.

EROSIONAL INDICATORS OF ICE MOVEMENT

During the 1984 field season the authors revisited the Cobequid Highlands in the study area. Two reference areas for erosional indicators of the northward ice movement were found. At Economy Lake, south of the map area, well developed mini crag and tail forms or pressure shadows on a northward sloping outcrop indicate an 188° ice flow. A southward-sloping rock surface approximately 550 yards (500 m) south of that outcrop reveals mini crag and tail forms from carbonate-cored siliceous nodules that indicate a 001° ice movement. This site was originally discovered, and the northward flow noted, by S. Bradley of Gulf Minerals Canada Ltd. (D. R. Grant, personal communication, 1980). A similar outcrop south of Wentworth on the Cobequid Highlands reveals 165° grooves cut by younger striations trending 020°. In other areas the two striated surfaces meet along a distinct line or bevel.

DEPOSITIONAL INDICATORS OF ICE MOVEMENT

A morphosequence refers to a continuum of landforms composed of stratified drift deposited at and beyond the margin of a glacier while deposition was controlled by a specific base level (Koteff and Pessl, 1981). On the southern side of the Cobequid Highlands (west of the study area) morphosequences are characterized by ice contact stratified drift, moraines, and ice contact deltas which grade southward into outwash plains and marine Gilbert type deltas (Stea, 1983; Stea et al., in press).

North of the Cobequid Highlands, between River Phillip and Wentworth, the direction of ice retreat, as indicated by morphosequences, is reversed (Fig. 1). The esker south of Athol reveals northward dipping crossbeds and imbricated clasts which indicate northward flowing meltwater. This esker complex grades northward into an outwash plain (Fig. 1). Similar sequences are found at the mouths of major valleys in the Cobequid Highlands east of Springhill. The meltwater that produced these

deposits was derived from ice which retreated southward to the Cobequid Highlands.

A till sheet characterized by a sandy matrix and local Cobequid Highlands lithologies was found on top of a more compact reddish brown till on the northern edge of the Cobequid Highlands (Fig. 1). The sandy till was probably deposited by northward flowing ice because it contains virtually no Carboniferous erratics. It does not extend onto the Cumberland-Pictou Lowlands, but erratics of Cobequid Highlands provenance are found on the surface and in the upper metre of a compact reddish brown till which forms the surface till over much of the Lowlands. The dispersal of these erratics will be discussed in the following section.

INFERRED STAND OF NORTHWARD FLOWING ICE

Figure 1 shows an inferred stillstand of northward flowing ice based on the distribution of transverse moraine, hummocky moraine, meltwater channels and ice contact gravels. The area north of the limit is characterized by fluted and drumlinized till. South of the limit the terrain varies from flat and featureless to rolling closer to the Cobequid Highlands. The surface till sheet north and south of the inferred stand is visually indistinguishable except for the presence of crystalline erratics on the till surface south of the stand. Large areas south of the limit are covered by ice contact gravels grading distally into outwash plains. Near Athol the stand is defined by a series of east-northeastward trending moraines and a large body of ice contact stratified drift (Fig. 1). Near Springhill the stand is defined by ice marginal gravel deposits and a large arcuate area of hummocky moraine composed of a reddish sandy till. In the eastern part of the study area the stand is defined by a large body of ablation till and a series of small moraines (Fig. 1).

Striations mapped by the authors (Stea and Finck, 1984), which indicate a northward ice movement, are found exclusively south of the limit. Five isolated striation sites mapped by Chalmers (1895) indicate a northward movement in areas north of the stand of northward flowing ice.

DISPERSAL OF INDICATOR LITHOLOGIES

Pebbles from samples in the study area were counted and classified as plutonic, volcanic, metamorphic, red sedimentary, grey sedimentary, and other. The red and grey sedimentary clasts are derived from the Lowlands. The assemblages of the plutonic, volcanic, and metamorphic (crystalline) erratics suggest that they are of Cobequid Highlands provenance.

Figure 2 shows the percentage of crystalline erratics at each sample site and contours of the crystalline percentages. The contours show a decrease in the percentage of crystalline erratics with increasing distance northward from the Cobequid Highlands. The percentage of crystalline erratics decreases from 99 per cent to approximately 30 per cent within 2.5 miles (4 km) of the Highlands. The decrease in erratic percentages becomes more gradual with increasing distance from the Cobequid Highlands. Figure 3 shows the percentage of crystalline erratics versus distance northward from the contact of the Cobequid Highlands. The

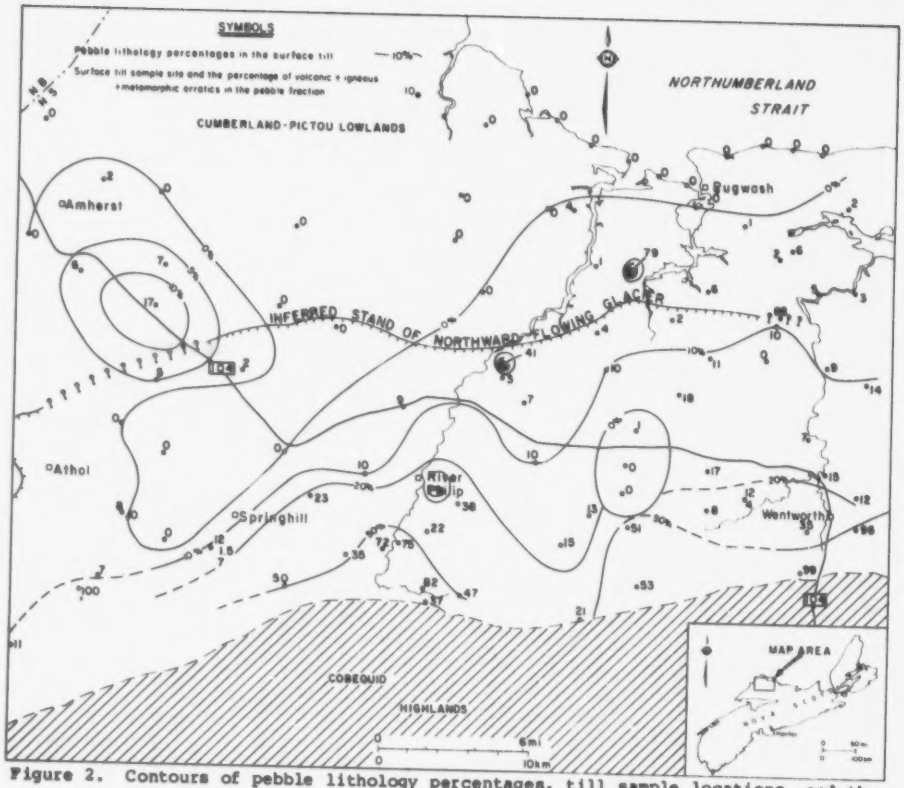

Figure 2. Contours of pebble lithology percentages, till sample locations, and the inferred stand of northward flowing ice based on morainal features and glaciofluvial morphosequences.

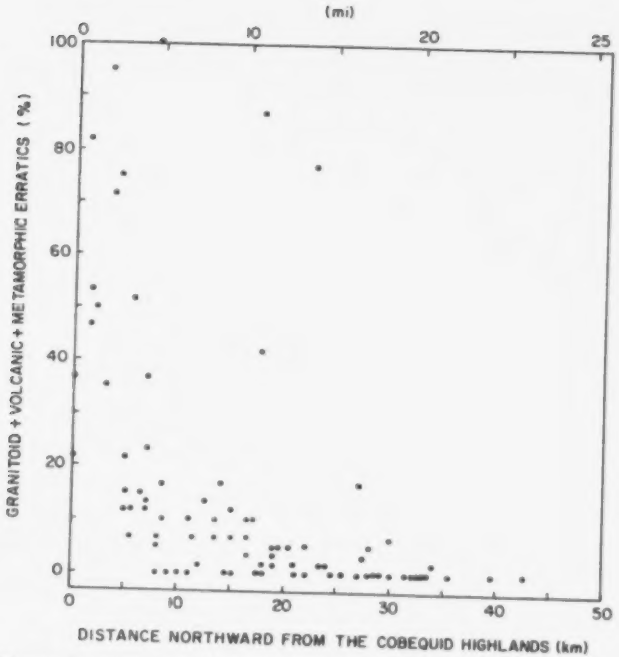

Figure 3. Plot of volcanic, metamorphic and intrusive pebble percentages with distance northward from the Cobequid Highlands massif.

decrease in erratics with increasing distance roughly conforms to the shape of a negative exponential curve which is a characteristic of glacial dispersal (Shilts, 1976). The Cobequid Highlands trend approximately east-west, perpendicular to ice flow inferred by glacial erosional features. Cobequid erratic dispersal is therefore parallel to the general trend of the northward ice flow and perpendicular to the source of indicator clasts.

In general the 0 per cent erratic pebble contour follows the inferred stand based on moraines (Fig. 2). This reinforces the concept that the moraines are an ice marginal feature. The northward deviation of the 0 per cent contour in the eastern area suggests that the ice may have at one point flowed beyond the inferred stand and retreated.

The distance ice flowed north across the Lowlands, as defined by the dispersal of crystalline erratics, generally increases from west to east. This may reflect a more vigorous northward ice flow in the eastern part of the study area (Stea and Finck, 1984). An erratic anomaly northeast of Athol (Fig. 1) and isolated striations suggest that a lobe of

ice may have advanced as far as Amherst. This glacier may have retreated to the postulated stand marked by ice contact statified drift near Athol.

EFFECTS OF NORTHWARD ICE FLOW ON TILL GEOCHEMISTRY IN THE CUMBERLAND-PICTOU LOWLANDS

The surface till in the Cumberland-Pictou Lowlands north of the Cobequid Highlands is primarily a reddish brown silty till derived from Carboniferous sedimentary rocks. It is believed to have been formed initially during a major southward to southwestward ice flow across the Carboniferous Lowland terrain (Stea and Finck, 1984). On visual examination, the colour and texture of the till sheet are similar north and south of the inferred glacier stand, although locally there are sandy tills which may represent ablation till related to the northward ice flow.

Ninety-seven surface till samples were collected from the Cumberland-Pictou Lowlands north of the Cobequid Highlands (Fig. 1). These samples were collected largely from the reddish silty till which represents the surface till sheet. Sandier and stonier till facies were also sampled, but only 7 samples were from the sandy ablation tills associated with hummocky moraine (Fig. 1). The samples were collected at an average depth of 4.9 feet (1.5 m) below the solum. The clay fractions (<2μm) of these samples were analyzed for 14 elements including Cd, Ag, Cu, Ni, Pb, Zn, Co, Fe, Mn, Ca, Mg, Mo, U, As; heavy mineral separates of the medium to fine sand fraction were analyzed for Sn and W. The clasts in each till sample were examined and percentages of erratics determined. The analytical procedures are discussed in Stea and Fowler (1979) and Stea (1982).

The nonparametric Spearman Rank Correlation method was used to:

1. assess the effects of provenance related parameters including the northward distance from the Cobequid massif, and the percentage of erratics on levels of the analyzed elements;

2. determine the effects of provenance, weathering, and sampling depth on the analyzed elements by elemental associations.

Provenance-related Variations

Table 1 shows the significant (99.0% confidence level) correlations between distance from the Cobequid Highlands, erratic percentages and geochemical elements. A strong negative correlation (-0.73) is seen between the percentage of erratics in the surface till and distance from the Cobequid Highlands. The elements Cu, Ni, Pb, Mg and Ca are significantly correlated with the parameters relating to northward ice flow. Cu and Pb levels are negatively correlated with distance and Pb levels are positively correlated with the percentage of Cobequid Highlands erratics.

Pb and Zn levels are concomitant with a positive correlation coefficient of 0.62 (Fig. 4). Cu and As levels also vary accordantly with Pb and Zn levels. The Pb and Zn association is likely to be provenance

Table 1. Spearman Rank Correlation Coefficients (rho) between geochemical elements and sample parameters relating to northward ice flow.

Northward flow Parameter	Sampling distance from Highlands (km)		Percentage Cobequid erratics (%Che)	
Element	Correlation Coefficient (rho)	Significance	Correlation Coefficient (rho)	Significance
Cd	-0.28	NS*	0.22	NS
Ag	0.03	NS	-0.07	NS
Cu	-0.39	S**	0.27	NS
Pb	-0.48	S	0.43	S
Zn	-0.22	NS	0.15	NS
Ni	0.27	NS	-0.36	S
Co	0.04	NS	-0.18	NS
Fe	0.09	NS	0.25	NS
Mn	0.02	NS	-0.19	NS
Ca	0.46	S	-0.40	S
Mg	0.54	S	-0.40	S
Mo	-0.19	NS	0.14	NS
U	-0.211	NS	0.15	NS
As	0.30	NS	0.19	NS
Sn	0.08	NS	-0.14	NS
W	0.07	NS	-0.10	NS
Distance (km)	-	-	-0.73	S
%Che	-0.73	S	-	-

* NS = not significant
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related because the mobilty of the two elements differs widely under oxidizing conditions (Rose et al., 1979, p. 25). Cu occurrences are widespread in the Cumberland-Pictou Lowlands (Chatterjee, 1983). Whole rock analyses of some of these occurrences show that Pb and Zn values are also elevated (above 500 ppm) (Ryan, in press). Pb occurrences in grey coaly sandstones and conglomerates have been discovered by recent mapping and exploration work in the region. The mineral commonly found is galena, but sphalerite and chalcocite are secondary components (Ryan, in press).

Figures 5 and 6 are scatter plots of the values of Cu and Pb and the distance northward from the Cobequid Highlands. Both plots show higher values (above 40 ppm) of Cu and Pb within the mapped stand of northward-flowing ice than beyond it. Peaks in Cu and Pb values are found in tills adjacent to the Cobequid Highlands and in tills north of the Cobequids up to the stand. Pb values vary accordantly with the percentages of erratics derived from the Cobequid Highlands and distance (Table 1). The Cobequid Highlands may be a source of Pb, but the pattern of decrease in Pb should be similar to the pattern of erratic dispersal (Fig. 3). A more plausible explanation is that mineralized Carboniferous bedrock sources within the limit were eroded and dispersed northward along with the Cobequid-derived erratics. Some of the elevated values of Pb in Figure 6 may be due to mineralization in the Boss Point Formation which has, in other areas, been known to carry Pb and Zn (R. J. Ryan, personal

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As	0.30	NS	0.19	NS
Sn	0.06	NS	-0.14	NS
W	0.07	NS	-0.10	NS
Distance (km)	-	-	-0.73	S
%CHe	-0.73	S	-	-

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related because the mobilty of the two elements differs widely under oxidizing conditions (Rose et al., 1979, p. 25). Cu occurrences are widespread in the Cumberland-Pictou Lowlands (Chatterjee, 1983). Whole rock analyses of some of these occurrences show that Pb and Zn values are also elevated (above 500 ppm) (Ryan, in press). Pb occurrences in grey coaly sandstones and conglomerates have been discovered by recent mapping and exploration work in the region. The mineral commonly found is galena, but sphalerite and chalcocite are secondary components (Ryan, in press).

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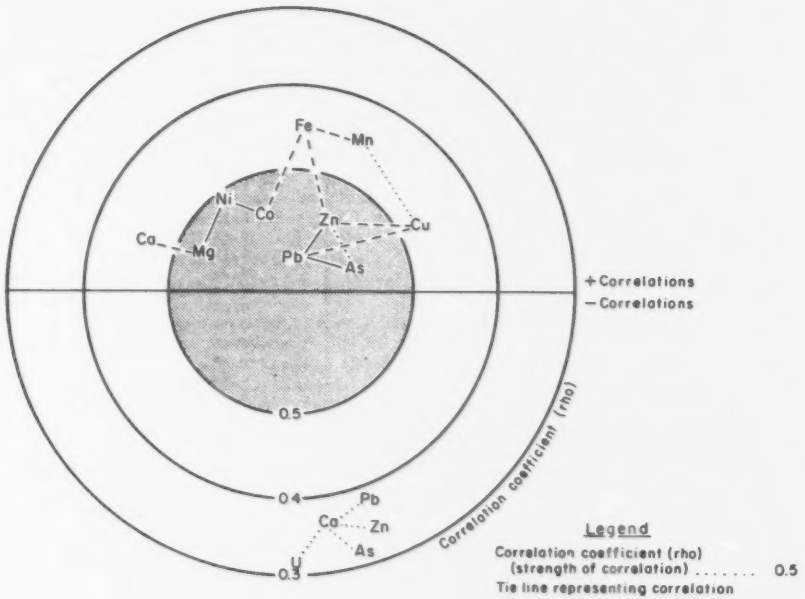

Figure 4. Plot of the significant (99.0% confidence level) elemental associations in the surface till.

communication, 1984). Till samples overlying the Boss Point Formation are circled. Many of these samples have Pb values over 90 ppm and Zn values over 200 ppm in the clay fraction. The highest Pb value in this suite of samples was 332 ppm accompanied by a 358 ppm Zn value. This sample was located southeast of River Phillip in bedrock of the Cumberland Group (Fig. 2). Some of the Pb anomalies further down-ice from the Boss Point outcrop may represent northward dispersal from this unit. R. J. Ryan (personal communication, 1984) noted distinct Pb-rich mineralized bedrock areas 9.3 miles (15 km) away from the Cobequid Highlands in the Tatamagouche Basin area. Figure 6 also shows Pb anomalies 8.7-9.9 miles (14-16 km) away from the Highlands. Fletcher (1905) postulated a Cu-rich zone running parallel to the Cobequid Highlands which falls within the limit of northward ice flow.

The reason for the negative correlation between Ca and Mg and erratic percentages is uncertain. The northward flow introduced some Cobequid Highland crystalline material into the Lowland till. This

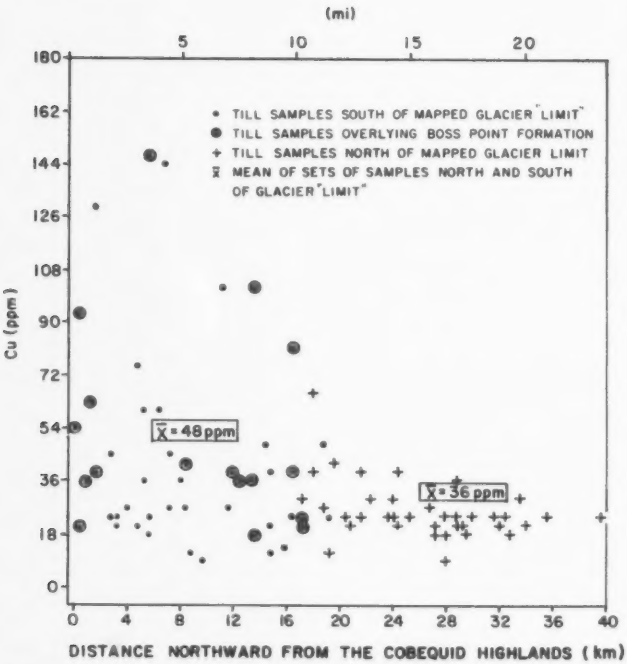

Figure 5. Plot of Cu levels in the surface till and distance northward from the Cobequid Highlands.

material may have diluted some of the calcium in the till matrix. The calcium and magnesium in the till fine fraction are largely derived from calcareous redbed sources in the Carboniferous Pictou and Cumberland Groups. Weathering of calcium and magnesium in the erratic-rich till samples may also explain this phenomenon. The erratic-rich samples may be slightly sandier than the erratic poor samples although they cannot be differentiated in the field. Figure 7 illustrates the inverse relationship of Ca to erratic pebble percentages. Depth of sample does not correlate significantly with either Ca or Mg levels.

Weathering Effects

Most of the samples were taken from a reddish silty till as stated earlier. This till has a substantial amount of clay-sized particles, up to 15 per cent of the total matrix. The fine fraction (<2μm) is composed largely of clay derived from red Carboniferous mudstones. Sandier till facies in the Lowlands, especially the ablation tills (Fig. 1), also have red clay in the matrix, but a larger proportion of these clay-sized particles may be present as Fe-Mn hydroxides, a result of in situ weathering or resedimented weathering products. Fe is moderately

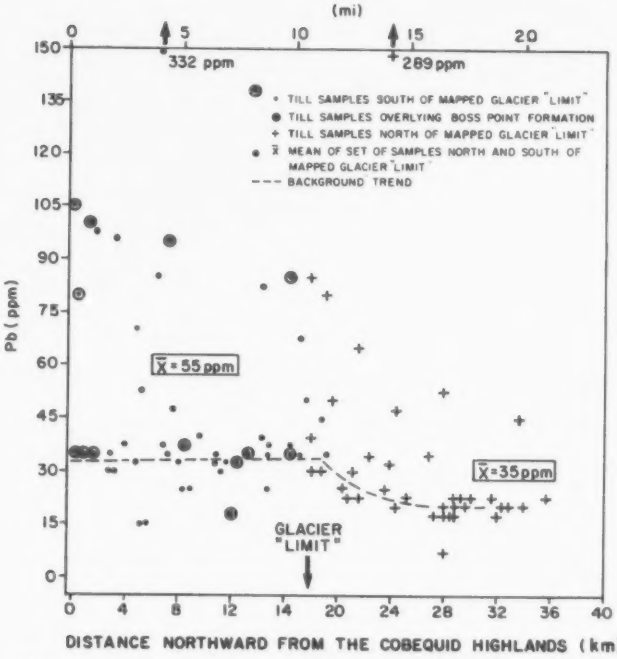

Figure 6. Plot of Pb levels in the surface till and distance northward from the Cobequid Highlands.

correlated with Zn (rho=0.40, Fig. 4) in the data set. A visual examination of the data shows that ablation till samples have generally higher Fe levels (>5% Fe-sandy samples, 3.3%-4.0%-silty samples) and Zn levels (>150 ppm-sandy samples, 80-130 ppm-silty samples). The ablation tills exhibited the highest Fe and Zn levels. The elevated Zn levels in the ablation tills may be due to adsorption or coprecipitation of Zn with Fe hydroxides. In this data set it is not difficult to separate weathering effects from those provenance-related element associations because the samples have been classified and the sandy tills mapped. Elemental associations can also help differentiate between these effects. The strongest correlation was between Pb and Zn levels (Fig. 4). An association of these two elements is unlikely if weathering processes were controlling element levels and creating false anomalies because these elements behave quite differently under oxidizing surficial conditions. In addition, Fe levels were not significantly associated with Pb levels. Samples that have anomalous Pb and Zn levels show normal Fe levels. Mapping conducted by the authors in an adjacent area (Stea et al., in press) has revealed texturally and lithologically distinct till sheets. These tills also show substantial differences in average element levels. A sandy till called the Shulie Lake Till has high average Fe and Zn values when compared to clay-rich tills.

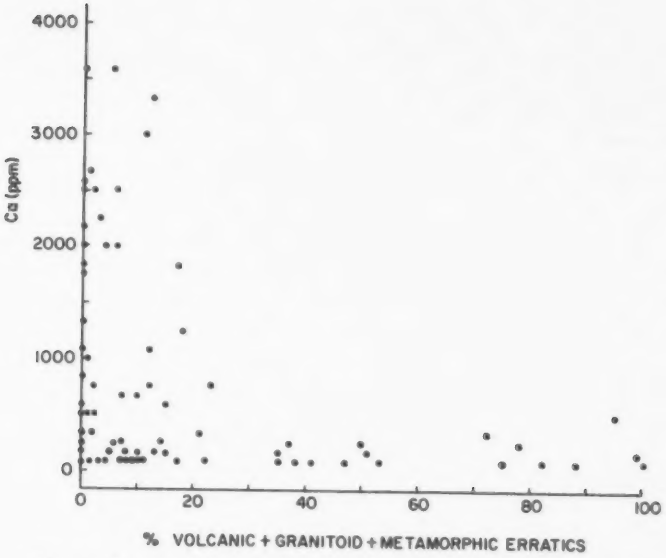

Figure 7. Plot of Ca levels and erratic pebble percentages in till samples north of the Cobequid Highlands.

CONCLUSIONS AND IMPLICATIONS FOR TILL PROSPECTING

Geological and geochemical evidence strongly suggest that ice flowed northward from the Cobequid Highlands onto the Cumberland-Pictou Lowlands. Morphosequences of hummocky moraine, ice contact stratified drift and outwash indicate a southward-retreating ice front. A local till sheet of Cobequid Highlands derivation overlies a reddish brown till sheet derived from rocks in the Carboniferous Lowlands. Striations on southward-facing stossed bedrock surfaces in the Lowlands indicate northward ice flow. A stillstand of this glacier is defined by moraines, ice contact stratified drift, and by the dispersion of Cobequid Highlands erratics on the Lowland till.

Element levels in the clay fraction of the reddish surface till sheet appear to have two controlling influences, provenance and weathering processes. Pb and Zn levels are strongly correlated, with anomalously high values of both elements commonly found in the same samples. Small Pb occurrences associated with grey coaly sandstones and conglomerates, may be the source of these high Pb and Zn values. Cu levels are also accordant with Pb and Zn levels in the till samples. Copper occurrences in the Cumberland-Pictou Lowlands have been found to have elevated Pb and Zn levels (Ryan, in press). All three elements are part of the same mineralizing process, which affected large areas of the Carboniferous basin and may have been responsible for the linear Cu zones described by Fletcher

(1905). A secondary influence to Zn levels is the amount of Fe in the till. This is especially significant in sandier tills, where Fe hydroxides form a large proportion of the clay fraction. Ca and Mg levels in the clay fraction of the surface till sheet may be controlled by the interaction of weathering processes and provenance. Both elements are negatively correlated with erratic percentages. The introduction of Cobequid Highlands erratic material into the Lowland till sheet by northward ice flow may have diluted the Ca and Mg levels directly, or indirectly reduced them by enhanced rates of weathering.

Care must be taken by exploration firms prospecting in areas within the northward ice flow terminus. The direction of transport of many surface boulders in this region is radically different from that north of the limit even though the surface till looks much the same. In the same way, geochemical anomalies in surface tills or soils may be displaced northward in this region. Figure 8 is a diagrammatic representation of the

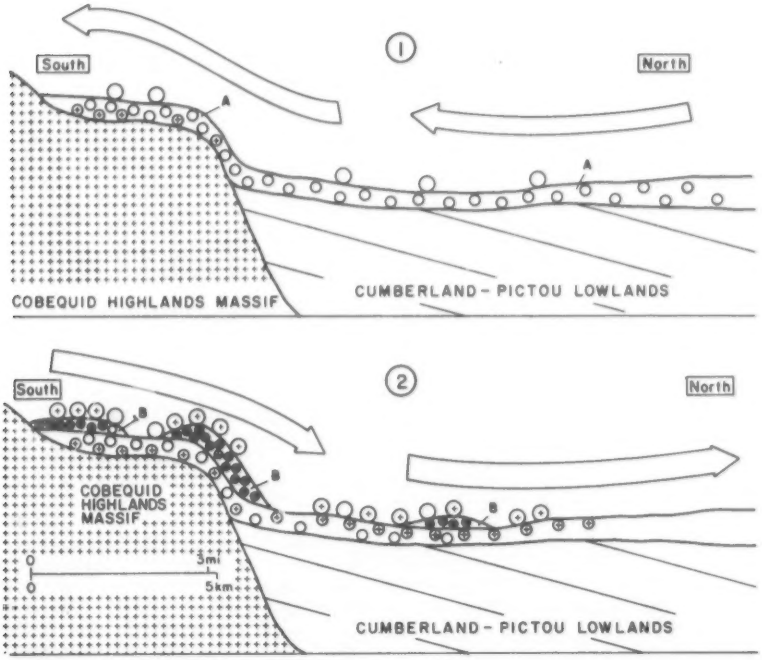

Figure 8. Diagrammatic representation of the sequence of ice flows and their deposits in the study area.
(1) Southward ice flow forming a red-brown silty till(A).
(2) North-northeastward ice flow forming a sandy local till(B) on the Cobequid Highlands and depositing Cobequid Highland erratics ● on the previously formed till.

effects of the last two ice flows in the region. The first, southward flow, formed a reddish-brown till and dispersed Carboniferous bedrock-derived erratics on the Cobequid Highlands. The second, northward flow, formed a local till sheet on some areas of the Highlands, and transported boulders northward onto the Cumberland-Pictou Lowlands. These boulders may have been transported in an englacial position and deposited on the surface of the previously formed till, essentially a matrix-less melt-out till as envisioned by Shilts (1973).

The majority of the samples obtained in this study were from one till sheet. The few samples obtained from a mapped ablation till (Fig. 1) showed significant differences in Fe and Zn contents. Element levels can vary significantly between till genetic facies (Shilts, 1975) and tills of differing provenance related to distinct ice flows (Stea, et al., in press). This study has emphasized the need to recognize till sheets in a mineral exploration program through surface mapping of Quaternary deposits.

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DISCRIMINANT AND FACTOR ANALYSIS OF GEOCHEMICAL DATA FROM GRANITOID ROCKS HOSTING THE MILLET BROOK URANIUM MINERALIZATION, SOUTH MOUNTAIN BATHOLITH, NOVA SCOTIA*

A. K. Chatterjee and D. F. Strong**

The Millet Brook uranium deposit of Nova Scotia occurs as closely spaced en-echelon pods and lenses within a northeasterly trending fracture zone over more than 0.6 miles (1 km) within 370 Ma old biotite granodiorite, the least differentiated phase of the granitoid rocks of the South Mountain Batholith. The main ore zone is found in a 262 yards (240 m) strike length, and total reserves for three zones have been estimated at about one million pounds of U_3O_8 at grades between 0.15 and 0.20 per cent. The mineralization is thought to be related to magmatic fluids derived from younger, more differentiated leucomonzogranite found as dykes and a cupola underlying it. The mineralization is surrounded by alteration zones up to 32.8 yards (30 m) wide, and represented by four main types, viz. potassic, sodic, ferruginous and calcic, marked particularly by loss of silica and enrichment of carbonate, analogous to the episyenites associated with similar deposits of western Europe. An evaluation of the numerous chemical changes accompanying this alteration has been made for 33 elements in 128 samples using the statistical techniques of correlation, discriminant function, and R-mode factor analysis. These show that patterns indicated by petrographic studies can be confirmed with a high degree of statistical confidence, and that other more subtle element associations and patterns can be recognized which may have broader metallogenic significance and metallogenic application.

*Uranium, v. 1, Elsevier Science Publishers B.V., Amsterdam, The Netherlands, 1984, p. 289-305.

**Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland.

RARE-EARTH AND OTHER ELEMENT VARIATIONS IN GREISENS AND GRANITES ASSOCIATED WITH EAST KEMPTVILLE TIN DEPOSIT, NOVA SCOTIA, CANADA*

A. K.Chatterjee and D. F. Strong**

SYNOPSIS

The East Kemptville deposit is located within a northeast-trending polymetallic tin domain of southwestern Nova Scotia, where tin occurs both in flyschoid sedimentary rocks and in Devonian granitoids. Cassiterite is found in all rock types of the Davis Lake Pluton in the East Kemptville area, but economic concentrations are restricted to greisens and greisenized granitoids - together with a complex assemblage of sulphide minerals. Geochemical studies of 137 samples of the greisens and associated granitoids show a continuum from one rock type to the other for most major and some trace elements, but sharp separation between the two for others. Rare-earth elements (REE) in 24 samples show a progressive depletion from the granitoid rocks to greisens with preferential loss of light REE in the early stages of alteration and near total loss of REE in the most tin-rich greisens. The data for these samples agree qualitatively with observations for other greisens, which have been explained by a complexing action of fluorine and other anions - differences in detail perhaps also resulting from such other variables as fluid/rock ratios. The sensitivity of REE to alteration processes suggests that they might provide a valuable adjunct to lithogeochemical exploration programs in granitoid rocks.

*Transactions of the Institution of Mining and Metallurgy, Section B: Applied Earth Science, v. 93, May 1984, p. B59-B70.

**Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland

POLYMETALLIC TIN DOMAIN IN SOUTHWESTERN NOVA SCOTIA*

A. K. Chatterjee and D. F. Strong**

In southwestern Nova Scotia tin mineralization occurs predominantly as veins in Cambro-Ordovician flyschoid metasedimentary rocks and in greisen zones associated with the polyphase leucocratic two-mica granitoid rocks of Devono-Carboniferous age. In the flyschoid rocks, the mineralized veins are enveloped by chlorite which shows systematic changes in F/FM ratio outward from the veins. Geochemically the mineralized rocks are enriched in Sn, Li, F, Cu, CO_2, Zn and Rb and enriched in LREES in comparison to the barren rocks. The cassiterite bearing mica and topaz greisens are spatially and genetically related to granitoid rocks which are tin-specialized. Geochemical studies of the granitoid rocks and the greisens show that there is a continuum between the granite and greisen for most major and some trace elements, and a sharp separation between them for others, e. g. F, U, Th, and Zr. REES show a progressive depletion from the granitoid rocks to greisens with preferential loss of LREES in the early stages of alteration and near total loss of REES in the most tin-rich greisens. The data agree qualitatively with observations for other greisens, which has been explained by complexing action of fluorine and other anions; it is probable that other variables such as fluid/rock ratio will have to be determined before a complete understanding is possible.

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**Department of Earth Sciences, Memorial University of Newfoundland, St. John's, Newfoundland

THE APPLICATION OF LITHOGEOCHEMISTRY TO TIN EXPLORATION IN SOUTHWESTERN NOVA SCOTIA*

A. K. Chatterjee

Exploration for base metals in southwestern Nova Scotia in 1976 resulted in the discovery of tin mineralization in the Cambro-Ordovician flyschoid metasedimentary rocks. The distribution of glacial boulders containing tin concentrations suggested a significant exploration target. Subsequently, Shell Minerals acquired the ground and discovered the East Kemptville tin deposit in the granitoid rocks of the South Mountain Batholith, approximately 25 miles (40 km) away from the initial discovery area. Rio Algom (the present owner) confirmed the possibility of economic recovery of tin from the ore, thus establishing North America's first economic primary tin deposit. The present paper deals with the lithogeochemistry of rocks in southwestern Nova Scotia and the potential use of such data in exploration programs seeking new tin deposits in this geological setting.

In southwestern Nova Scotia tin occurs as cassiterite in quartz-topaz greisens hosted by Devono-Carboniferous granitoid rocks (East Kemptville) and also in quartz-chlorite veins hosted by Cambro-Ordovician flyschoid metasedimentary rocks of the Meguma Group. Though the geological setting, mineralogy and other features are vastly different in the above environments, the tin mineralization is linked exclusively with one type of granite, the tin-specialized granite of southwestern Nova Scotia. The concept of tin-specialized granites requires that they be distinct and different from other granites which are apparently similar and yet barren. Obviously, this distinction is critical to exploration and lithogeochemistry provides a basis for its recognition.

In southwestern Nova Scotia, the distinguishing features of tin-specialized granites are: overall leucocratic nature, Ti-poor Sn-F-rich biotites, Fe-poor muscovites, albite generally An less than 7 per cent, normative corundum generally less than 3 weight per cent. The most important distinguishing feature is that the essential rock-forming minerals do not appear to have been formed due to magmatic co-crystallization (suggested by partition of elements in coexisting mineral pairs). Also, tin-specialized granites are characterized by a special association of accessory minerals, among which cassiterite, helvite, uraninite, topaz, dark micas of siderophyllite-protolithionite composition, fluorite, chalcopyrite and sphalerite are important.

In order to differentiate the tin-specialized granites from other granites of the South Mountain Batholith, it is important to consider at least two processes which control the behaviour and distribution of major and trace element geochemistry. One of these processes is dominated by fractional crystallization of mineral phases, producing a comagmatic suite of rocks in which differentiation is accompanied by progressive enrichment in F, Be, Li, Rb, Cs, Ta, Sn and depletion in Sr, Ba, REES, Sc, Zr and Hf.

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The second process is dominated by the interaction of fluid phase with the residual magma or previously crystalline rocks or both, producing a para-intrusive rock which includes varieties of biotite-muscovite granite in which elemental correlation often breaks down. Particular elements, for example Rb, Li, F, Cu and U, show an extreme enrichment. Others may show extreme depletion, for example Ba, REES, Zr, Hf and Th. Thus, breakdown in elemental correlation and extreme enrichment or depletion are characteristic features of tin-specialized granites which allow them to be distinguished from other granites.

Essential to the recognition of tin-specialized granites is the pattern of associated hydrothermal mineralization. This can be evaluated by means of covariance diagrams involving the most characteristic elements of the granite and greisen, for example F-Li-Sn. The mean concentration of these elements in the granite is 3,318, 146 and 50, whereas in the greisen it is 15,090, 1,000 and 820 (ppm) respectively. At first glance, it appears that the numerical values are hardly related, but covariance among these three elements suggests that a relatively constant Li/F ratio is maintained during tin enrichment. This covariance immediately signifies a similarity in geochemical behaviour of Li and F both in granitic melts and greisen fluids. Also, covariance relationship among Li/F, through Li/U to Li/Th show that there is an increasing separation of the granites and greisens throughout the full range of tin enrichment.

Lithogeochemistry adequately fingerprints the tin-specialized granites of southwestern Nova Scotia. The relationship among Li/F/Sn, Li/U/Sn, and Li/Th/Sn is critical to the distribution between barren and potentially mineralized granites and therefore provides a fundamental tool for mineral exploration.

VARIATION IN GRANITOID ROCKS ALONG HIGHWAY 103 BETWEEN CHESTER AND HALIFAX*

M. A. MacDonald

INTRODUCTION

In recent years numerous authors have successfully subdivided large areas of granitic rocks into separate mappable units by using both textural and compositional criteria (Cobbing et al., 1981; Dickson, 1983). The purpose of this project is to record some of the typical variations in a portion of the South Mountain Batholith (SMB) prior to the commencement of a major mapping program in the Batholith and to determine if these techniques for classification can be applied in the SMB as a whole. The excellent exposure of granitoid rocks along Highway 103 was chosen as the study area. The eastern end of the Highway from St. Margarets Bay to Halifax crosses the Halifax Peninsula previously mapped by Smith (1974). Smith recognized a late intrusive alaskite body near Tantallon and, with the exception of granodiorite near the Halifax granite/metasediment contact, mapped the rest of the rocks as quartz monzonite which he later referred to as biotite granite (Smith and Turek, 1976).

RESULTS OF FIELD MAPPING

In the fall of 1984, one week was spent mapping the field area. Thirty-six representative samples were collected (Fig. 1), slabbed and stained for alkali feldspar content using sodium cobaltinitrite. A thin section was prepared from each sample. The granitoid rocks were subdivided into five lithotypes on the basis of their textures and mineralogy (Fig. 1). Classification of rock types is after Streckeisen (1976). Large euhedral, perthitic alkali feldspar phenocrysts commonly in excess three centimetres long are termed megacrysts. Grain sizes are defined as: fine $\leq$ 0.1 cm; medium 0.1 to 0.5 cm; and coarse 0.5 to 3 cm. All rocks contain quartz, alkali feldspar and plagioclase. Biotite, when present, contains inclusions of apatite and zircon unless otherwise stated. Saussuritization refers to the secondary minerals produced by deuteric or hydrothermal alteration of calcic plagioclase. These include zoisite, calcite-sericite and calcite. Pinite is the common alteration product of cordierite and "consists of a fine felty mixture of muscovite with some chlorite or serpentine minerals and iron oxides" (Deer et al., 1966).

Unit 1 Biotite Granodiorite (Fig. 2A): medium grained; light bluish grey to grey; equigranular with perthitic megacrysts; megacrysts ($\leq$ 5% of outcrop) frequently are so inclusion-rich that they may be confused with groundmass; biotite (approximately 15%) is fresh; plagioclase displays oscillatory zoning with slightly to moderately saussuritized calcic cores and may have apatite inclusions; trace muscovite occurs as intergrowths with biotite (secondary?) and as alteration of alkali feldspar; trace opaques (ilmenite?); metasedimentary xenoliths and aplite dykes are common.

Unit 2a Biotite Transitional Monzogranite: Medium- to predominantly coarse-grained; light grey to grey; generally equigranular with minor

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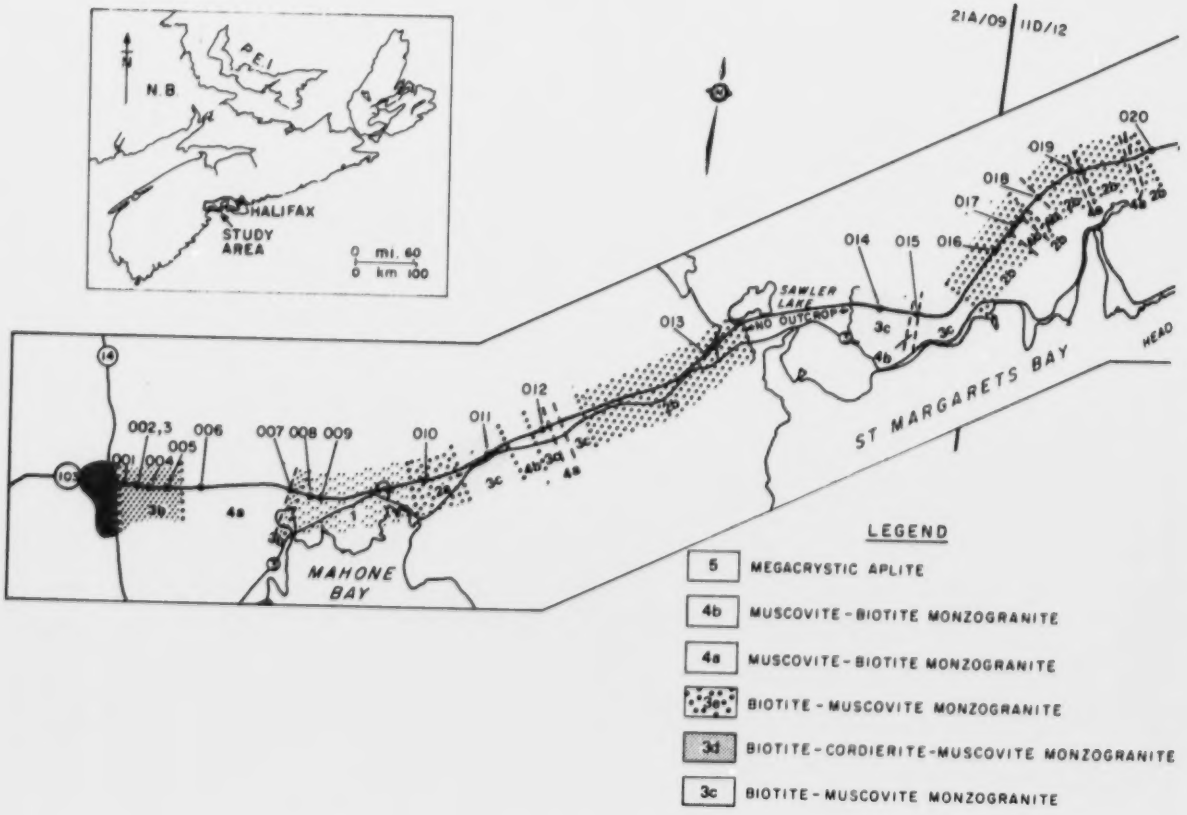

N.B
P.E.I
HALIFAX
STUDY AREA
0 mi. 60
0 km 100
21A/09
11D/12
SAWLER LAKE
NO OUTCROP
ST MARGARETS BAY
HEAD
MAHONE BAY
001
002,3
004
005
006
007
008
009
010
011
012
013
014
015
016
017
018
019
020
LEGEND
5 MEGACRYSTIC APLITE
4b MUSCOVITE-BIOTITE MONZOGRANITE
4a MUSCOVITE-BIOTITE MONZOGRANITE
3c BIOTITE-MUSCOVITE MONZOGRANITE
3d BIOTITE-CORDIERITE-MUSCOVITE MONZOGRANITE
3c BIOTITE-MUSCOVITE MONZOGRANITE

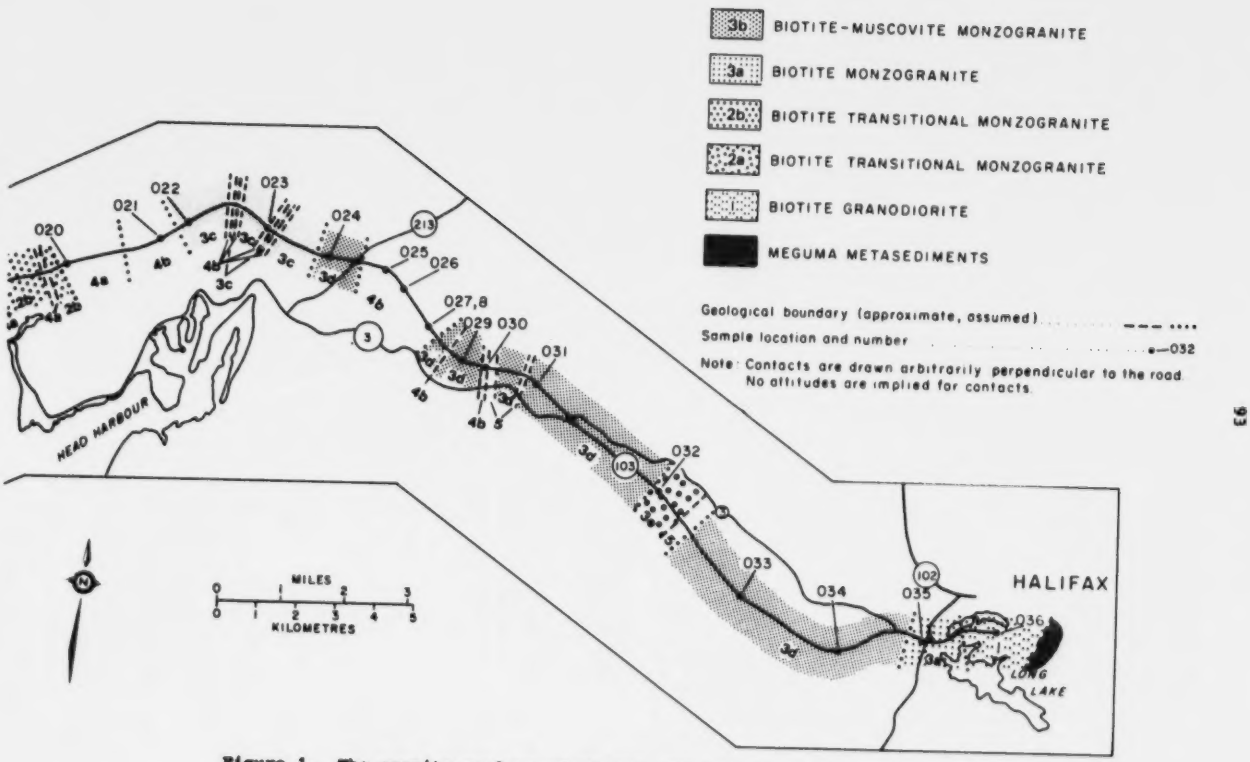


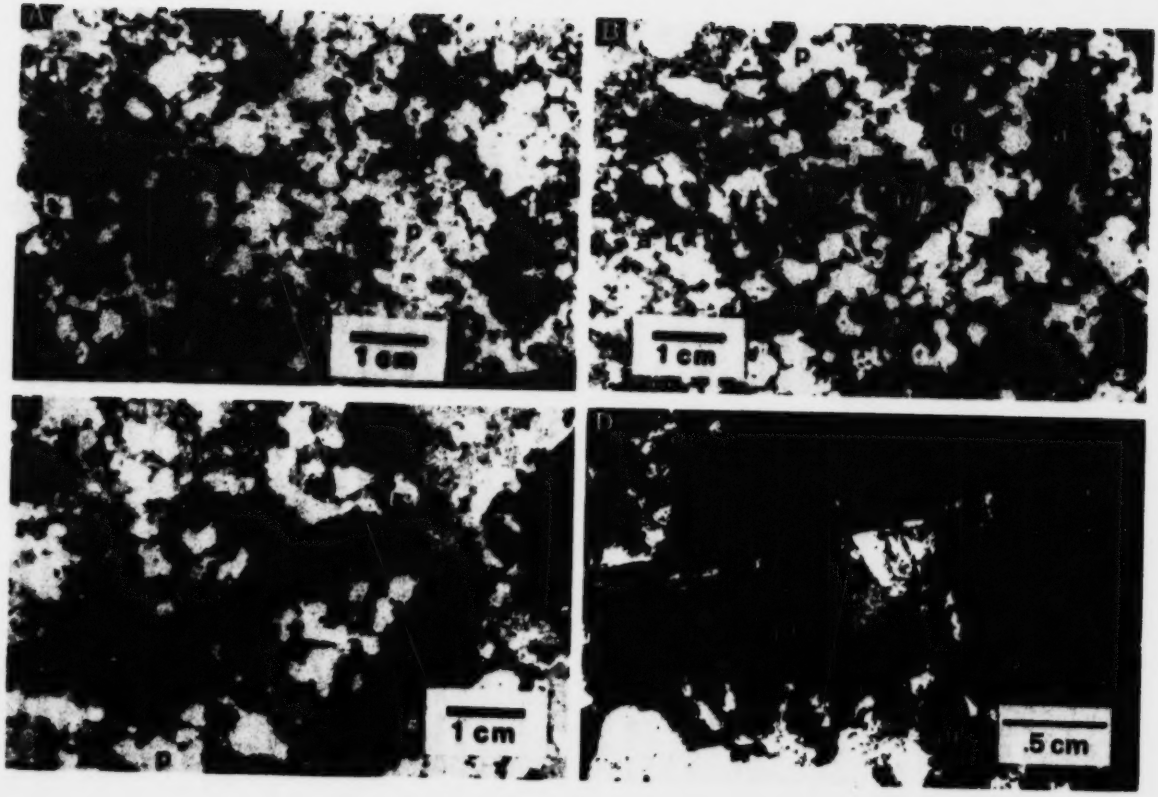
Figure 1. The granite geology of Highway 103 between Halifax and Chester.

Figure 2. A) Biotite granodiorite (sample 036).

B) biotite transitional monzogranite (sample 019).

C) biotite monzogranite (sample 035). Stained slabs show the proportions of light grey quartz (q), dark grey to black alkali feldspar (a) and white plagioclase (p).

D) photomicrograph of cordierite (crossed polars) in biotite monzogranite (sample 035). Fresh cordierite in centre of photograph displays sector twinning. Note the characteristic alteration to pinite (pi).


A
P
1 cm
B
P
1 cm
P
1 cm
D
.5 cm

megacrysts (< 5%); compositions on QAP (quartz-alkali feldspar-plagioclase) diagram cluster near the granodiorite-monzogranite join; biotite is predominantly fresh with minor chlorite alteration and may have inclusions of zircon and apatite in zones; muscovite is present in trace amounts, but is slightly more abundant than in the biotite granodiorite; muscovite is intergrown with biotite, but is predominantly an alteration of alkali feldspar; plagioclase is normally zoned with some development of oscillatory zoning and calcic cores may be moderately saussuritized; anhedral to subhedral, interstitial cordierite is a minor phase ($\leq$ 1%) and is totally pseudomorphed by pinite and lesser amounts of muscovite; plagioclase may contain discrete inclusions of apatite and biotite; metasedimentary xenoliths are common.

Unit 2b Biotite Transitional Monzogranite (Fig. 2B): predominantly medium grained matrix with larger, coarse grained quartz, alkali feldspar and plagioclase; brownish- to greenish-grey; inequigranular, hypidiomorphic granular and massive (nonfoliated); slightly megacrystic ($\leq$ 5%); compositions straddle monzogranite-granodiorite join on QAP diagram; biotite is relatively fresh with minor alteration to chlorite plus acicular rutile, apatite and zircon inclusions may be zoned; biotite may also contain stubby, subhedral rutile inclusions; trace muscovite as in Unit 2a; subhedral interstitial cordierite is partially to totally pseudomorphed by pinite plus minor muscovite; plagioclase is normally zoned (oscillatory zoning in part) with slight to moderate saussuritization of calcic cores; metasedimentary xenoliths are common.

Unit 3a Biotite Monzogranite (Fig. 2C): medium- to predominantly coarse-grained, bluish grey to grey; hypidiomorphic granular; megacrystic (up to approximately 20% of outcrop); biotite is fresh with minor chloritization; inclusions of apatite are larger than in Units 1-2b ($\leq$ 1 mm versus $\leq$ 0.1 mm); trace to minor muscovite occurs mostly as alkali feldspar alteration and to a lesser extent in the cores of zoned plagioclase; cordierite may have fresh cores with sector twinning (Fig. 2D), however it is extensively altered to pinite, muscovite and chlorite; plagioclase has normal and patchy zoning with slightly saussuritized cores; hand specimens and unstained slabs resemble biotite granodiorite, however staining reveals substantial alkali feldspar content; thin aplite and pegmatite dykes (mostly $\leq$ 10 cm) are abundant which may contain garnet, tourmaline or beryl.

Unit 3b Biotite-Muscovite Monzogranite (Fig. 3A): medium- to coarse-grained; medium greenish grey to grey; hypidiomorphic granular; megacrystic (5-20%); may have weakly defined foliation by parallel alignment of megacrysts; aplites present but not abundant; may have large ($\geq$ 1 cm) subhedral to euhedral cordierite crystals (partially to totally pseudomorphed by muscovite, chlorite and pinite) which seldom constitute more than 2% of rock; fresh cordierite may be twinned; cordierite also occurs as subhedral interstitial totally pseudomorphed grains; biotite (5-8%) is fresh to extensively chloritized and may have stubby subhedral rutile crystals; plagioclase has normal zoning with extensively saussuritized cores; muscovite (>1%) commonly replaces alkali feldspar in irregular patterns (Fig. 3B); quartz, alkali feldspar and plagioclase may poikilitically enclose small, fresh, inclusion free crystals of biotite; minor metasedimentary xenoliths.

Unit 3c Biotite Muscovite Monzogranite (Fig. 3C): fine- to medium-grained, coarse-grained in part; greenish- to brownish-grey; inequigranular, hypidiomorphic granular; megacrystic in part (≤ 5% of outcrop); massive biotite is generally fresh, but frequently shows extensive chloritization and may have stubby subhedral rutile inclusions and ilmenite (along cleavage planes); alkali feldspar may be moderately sericitized; plagioclase shows normal zoning with variably saussuritized calcic cores; cordierite is present in minor amounts (1-2%) and occurs predominantly as small subhedral interstitial crystals with minor euhedral, blocky, hexagonal, prismatic crystals (≥ 1 cm long); cordierite is generally totally replaced by muscovite, chlorite and minor amounts of pinite; muscovite (1-5%) is mostly a replacement of alkali feldspar; may be devoid of xenoliths and aplite-pegmatite dykes in part.

Unit 3d Biotite Cordierite Muscovite Monzogranite (Fig. 3D): medium- to predominantly coarse-grained; light to medium grey, brownish- or bluish-grey; hypidiomorphic granular; inequigranular; very megacrystic (> 50% megacrysts in part, average 20-30%); large euhedral pseudohexagonal prismatic crystals of cordierite (0.5-1.5 cm long) are diagnostic (may constitute ≥ 5% of mode); biotite may contain elliptical inclusions (parallel to cleavage) of alkali feldspar (and ilmenite?) similar to features described in the Musquodoboit Batholith (MacDonald, 1981); cordierite is invariably altered to pinite, muscovite and chlorite; a few euhedral muscovite crystals were noted and these may represent primary magmatic crystallization; megacrysts may contain inclusions of quartz in zones; tourmaline and garnet (Fig. 4A) may be present as accessory minerals; outcrops are commonly foliated (Fig. 4A) with both pervasive parallel arrangements of megacrysts and highly irregular orientations; metasedimentary xenoliths and aplite-pegmatite dykes (< 10 cm thick) are common features.

Unit 3e Biotite Muscovite Monzogranite (Fig. 4B): medium grained, some outcrops have fine grained matrix (approaching aplitic); medium yellowish- to brownish-grey; equigranular, hypidiomorphic granular, megacrystic in part (5-15%); megacrysts are yellowish orange in colour and are inclusion-rich with inclusions mostly of quartz in zones; secondary muscovite is present as very small- to medium-sized irregular crystals and, in part, approaches equal proportions with biotite; clusters of complexly intergrown chlorite and muscovite may represent the pseudomorphic replacement of cordierite; biotite is extensively altered to chlorite; plagioclase is mostly unzoned, however, some is normally zoned with extensively altered cores, a few zircon inclusions were noted in plagioclase; massive, nonfoliated; minor metasedimentary xenoliths.

Unit 4a Muscovite Biotite Monzogranite: fine- to medium-grained; yellowish to orangish-brown; equigranular with minor amounts of quartz, alkali feldspar, plagioclase and muscovite phenocrysts, ranging in size from 0.5 to 1 cm and constituting ≤ 5% of rock; muscovite occurs as secondary alteration products as in other units and as primary-looking, subhedral to euhedral crystals; alteration of biotite ranges from fresh to extensively chloritized ± opaque mineral (ilmenite?); biotite may have stubby rutile inclusions, but is characteristically inclusion-free; plagioclase is typically unzoned or slightly zoned (albitic composition) and is slightly altered to saussurite ± calcite; euhedral to subhedral primary andalusite similar to that reported by Clarke et al. (1976) (i.e. always rimmed by

Figure 3. A) Biotite-muscovite monzogranite (sample 005) stained slab. Large black alkali feldspars (a) display perthitic exsolution, and plagioclase (p) and quartz (q) are whitish and light grey respectively.

B) photomicrograph of muscovite (m) replacing alkali feldspar (a) (crossed polars) in biotite-muscovite monzogranite (sample 005).

C) biotite-muscovite monzogranite (sample 011).

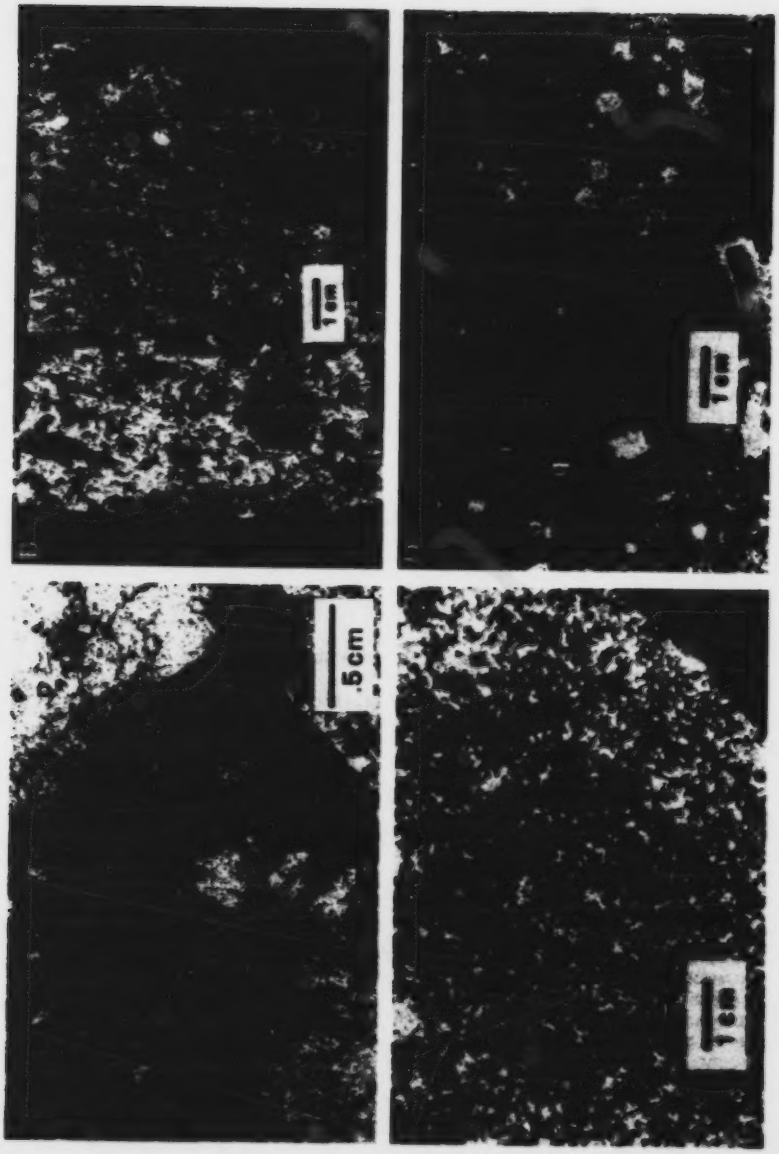
D) biotite-cordierite-muscovite monzogranite (sample 034) stained slabs show proportions of black alkaki feldspar (a), whitish plagioclase (p) and grey quartz (q). Note the parallel arrangement of alkali feldspar megacrysts which defines a primary flow foliation.

B
E
.5cm
D
P
1cm
P
1cm
1cm

Figure 4. A) Photomicrograph (plane-polarized light) of a garnet inclusion (g) in plagioclase (p) in biotite-corierite-muscovite monzogranite (sample 024). Note the anhedral crystal form which differs from the primary-magmatic almandine-spessartine garnets common in late-stage aplites and pegmatites. Note also the inclusion-free nature of the crystal which is unlike garnet from the metamorphic aureole.

B) biotite-muscovite monzogranite (sample 032), unstained slab. Note the overall equigranular texture with a megacryst of alkali feldspar (a).

C) and D) Muscovite-biotite monzogranite (samples 027 and 028) stained slabs indicate proportions of black alkali feldspar (a), whitish plagioclase (p) and grey quartz (q). Samples were taken from the same unit (4b) approximately 32.8 yards (30 m) apart. Note the extreme variation in grain size and texture from fine grained equigranular (4C) to porphyritic (4D). Phenocrysts in sample 028 (4D) are comprised of quartz (q), alkali feldspar (a) and zoned plagioclase (p).


1cm
1cm
.5cm
1cm

secondary muscovite) and apatite are accessory mineral phases; massive (i.e. nonfoliated); fractures in outcrop usually contain manganese or hematite staining.

Unit 4b Muscovite Biotite Monzogranite: fine- to medium-grained, grain size tends to be highly variable; wide range of textural characteristics from equigranular with a few phenocrysts to porphyry textures; these textural and grain size variations may vary drastically over several tens of metres (e.g. Fig. 4C and 4D); phenocrysts range in size from 0.5 to 2.0 cm and are primarily comprised of quartz, alkali feldspar, plagioclase (often with albite rims) and smaller phenocrysts ($\leq$ 0.5 cm) of muscovite and biotite; muscovite is mainly an alteration product of alkali feldspar, however, minor euhedral primary-looking crystals are present; biotite is usually chloritized to some degree and some grains contain stubby subhedral rutile inclusions; phenocrysts of plagioclase display normal or patchy zoning whereas smaller groundmass grains are mostly unzoned (albitic) or weakly zoned; euhedral, primary andalusite ($\leq$ 1 mm), similar to that described in Unit 4a, may be present in trace amounts; myrmekite intergrowths of quartz and plagioclase, and quartz and alkali feldspar may occur; complex intergrowths of muscovite and chlorite similar to those in Unit 3e may represent pseudomorphs after cordierite.

Unit 5 Megacrystic Aplite (this unit is limited in areal extent (Fig. 1) and the description is based entirely upon field observations): fine grained matrix with common megacrysts (up to 20%); light brownish grey, groundmass may be equigranular (aplitic) or slightly porphyritic with phenocrysts ($\leq$ 1 cm) of quartz, alkali feldspar and plagioclase; may also have small ($\leq$ 0.5 cm) biotite $\pm$ muscovite phenocrysts; proportions of biotite and muscovite are variable, however, biotite is usually the dominant mica.

SUMMARY AND CONCLUSIONS

It is apparent from this preliminary investigation that there is substantial textural and compositional variation in the granitic rocks of the SMB exposed along Highway 103. Parameters which may be used in subdividing the Batholith into lithotypes include: composition (i.e. feldspar ratio); grain size; colour; texture; mica content and proportion (i.e. biotite: muscovite); percentage of megacrysts; development of primary fabrics (i.e. flow foliation); content of cordierite and trace mineralogy (e.g. presence and mode of occurrence of andalusite, garnet, cordierite, tourmaline, rutile, apatite, beryl). A summary of the distinguishing characteristics of each unit is presented in Table 1.

Some of the critical observations were made subsequent to slabbing and staining of the samples, a procedure which not only defines the modal composition, but also enhances the textural features. Therefore a synchronized program which combines detailed field observations with feldspar staining procedures is crucial if the granitoid rocks of the SMB are to be properly subdivided.

Table 1. Summary of distinguishing characteristics of each unit.

UNIT NUMBER AND NAME	DISTINGUISHING CHARACTERISTICS
1 Biotite granodiorite	medium grained with ≤ 5% megacrysts; equigranular; light bluish-grey to grey; bi approximately 12-14%; common aplite dykes; common metasedimentary xenoliths.
2a Biotite Transitional Monzogranite	monzogranite similar to Unit 1 except: medium- to predominantly coarse-grained; lacks bluish colour; more mu; ≤ 1% ct (small subhedral crystals); more K-fel with compositions near granodiorite monzogranite join.
2b Biotite Transitional Monzogranite	similar to Unit 2a except: predominantly medium grained; inequigranular.
3a Biotite Monzogranite	medium- to predominantly coarse-grained; bluish-grey to grey; trace mu and ct (may be fresh); resembles bi granodiorite, however stained slab indicates monzogranite composition; approximately 20% megacryst; common aplite dykes; common metasedimentary xenoliths.
3b Biotite-Muscovite Monzogranite	medium- to coarse-grained; greenish-grey to grey; megacryst 5-20%; ct ≤ 1-2% (as blocky crystals ≥ 1 cm and smaller subhedral crystals); mu > 1%; bi 5-8%; may be foliated.
3c Biotite-Muscovite Monzogranite	similar to 3b except: fine- to medium-grained; inequigranular; megacryst ≤ 5%; ct mostly small subhedral with minor large blocky crystals; may be devoid of xenoliths and aplite dykes.
3d Biotite-Cordierite-Muscovite	predominantly coarse grained; light- to medium-grey; megacryst up to 50%, mostly 20-30; large euhedral blocky ct up to 5%; foliated.
3e Biotite-Muscovite Monzogranite	medium grained; medium yellowish- to brownish-grey; locally martrix approaches aplitic; equigranular; mu ≤ bi.
4a Muscovite-Biotite Monzogranite	fine- to medium-grained; yellowish- to orangish-brown; equigranular with ≤ 5% phenocrysts (0.5-1.0 cm); mu ≥ bi.
4b Muscovite-Biotite Monzogranite	similar to Unit 4a except: less equigranular; highly variable texture over tens of metres; very porphyritic in part; ≥ 10% phenocrysts (porphyry); phenocrysts (0.5-2.0 cm).
5 Megacrystic Aplite	similar to Unit 4b however majority of phenocrysts are K-fel megacryst in predominantly aplitic matrix.

List of abbreviations: bi - biotite; ct - cordierite; K-fel - alkali feldspar; mu-muscovite

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AIRPHOTOGRAPH INTERPRETATION OF THE SURFICIAL GEOLOGY OF MAP SHEETS 11D/05, 11D/12, 21A/16

P. W. Finck

INTRODUCTION

The study of surficial geology forms an integral part of the South Mountain Batholith (SMB) project. Emphasis has been placed on compiling geochemical, surficial and bedrock information pertaining to the SMB. In addition, a detailed airphotograph interpretation of the surficial geology for map sheets 11D/05, 11D/12, 21A/16 was completed. This report illustrates some of the major features recognized through airphotograph interpretation.

PREVIOUS WORK

There are a number of publications which describe the surficial deposits of central and southwestern Nova Scotia (Stea and Brisco, 1984). Investigations by Stea and Fowler (1979b) are the most relevant. They incorporate much of the existing surficial information within a regional framework and develop a stratigraphic column within which to classify the various deposits MacDougall et al. (1963) and Cann et al. (1954) was also referenced during the airphotograph interpretation.

Figures 1 and 2 illustrate the surficial features recognized by Stea and Fowler (1979b) with a follow-up airphotograph interpretation by the author. These features are briefly described in the following section.

EROSIONAL FEATURES OF ICE MOVEMENT

Linears or lineaments can be divided into two types: (1) linears formed by the erosion of surficial materials generally parallel to ice movement; (2) linears relating to joint systems, faults or shear zones which may or may not have been preferentially eroded by glacial ice. Depending on their scale, linears are relatively easy to identify on airphotographs. However, determining whether a linear is strictly an erosional feature, structurally controlled or a combination of both, requires detailed field mapping.

Figure 1 shows a radial pattern of linears north of Millet Brook. The orientation of the linears swings from 350°-170° to 015°-195°. Other northwest-southeast, northeast-southwest linears are found in areas of bedrock exposure or thin till veneer. These linears probably relate to the major southwest, south and northeast ice movements mapped by Stea and Fowler (1979). Ice erosion may have enhanced fault and fracture systems in the granite. The importance of recognizing linears is illustrated by the correlation of mineralized zones, such as Millet Brook (Chatterjee and Strong, 1984) and East Dalhousie (Lowe and Farstad, 1977), with 060° trending shear zones.

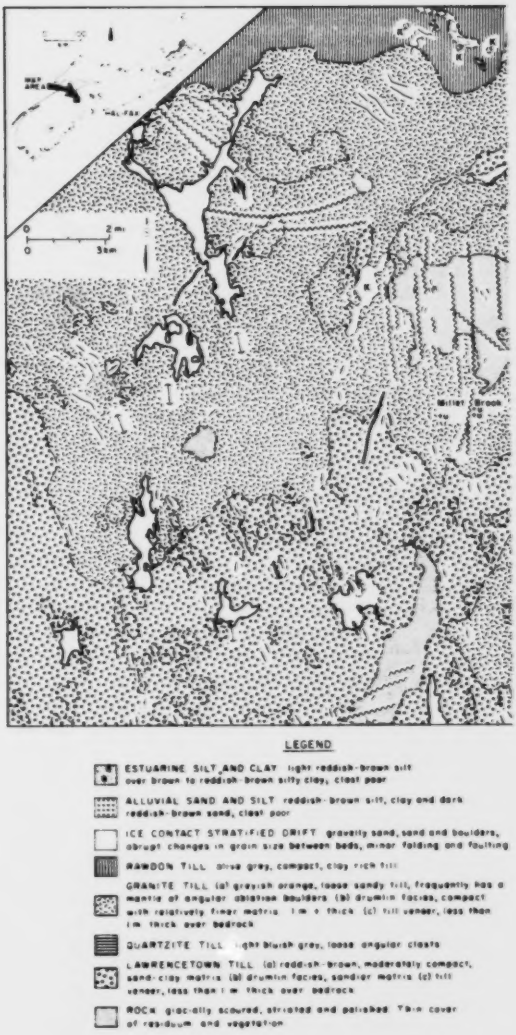

0 2mi
0 3km
Miller Brook
LEGEND
ESTUARINE SILT AND CLAY light reddish-brown silt over brown to reddish-brown silty clay, clast poor
ALLUVIAL SAND AND SILT reddish-brown silt, clay and dark reddish-brown sand, clast poor
ICE CONTACT STRATIFIED DRIFT gravelly sand, sand and boulders, abrupt changes in grain size between beds, minor folding and faulting
RAWDON TILL olive grey, compact, clay rich till
GRANITE TILL (a) greyish orange, loose sandy till, frequently has a mantle of angular ablation boulders (b) drumlin facies, compact with relatively finer matrix 1 m + thick (c) till veneer, less than 1 m thick over bedrock
QUARTZITE TILL light bluish grey, loose angular clasts
LAWRENCETOWN TILL (a) reddish-brown, moderately compact, sand-clay matrix (b) drumlin facies, sandier matrix (c) till veneer, less than 1 m thick over bedrock
ROCK glacially scoured, striated and polished Thin cover of residuum and vegetation

Figure 1. Surficial geology modified from Stea and Fowler (1979b) with supplementary airphotograph interpretation.

SYMBOLS

Glacial striations, sense of ice flow unknown

Terrace scarp

Ice abraded, linear bedrock ridges, whalebacks roche moutonnee

Gradational contact between major till units

Gradational contact between till facies and minor surficial deposits

Kame

Kettle hole

Lineations, may or may not be structurally controlled, varying degrees of ice scour along structurally weakened zones

Major morainal ridge, minor moraine

Drumlin

Glacial meltwater channels (arrow indicates direction of flow)

Mineral prospects

Eskers (direction unknown)

Figure 1. Continued.

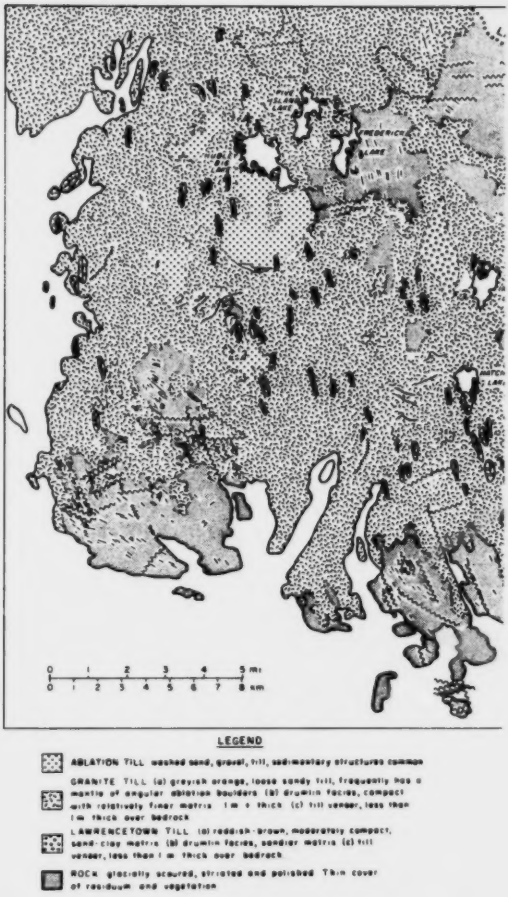
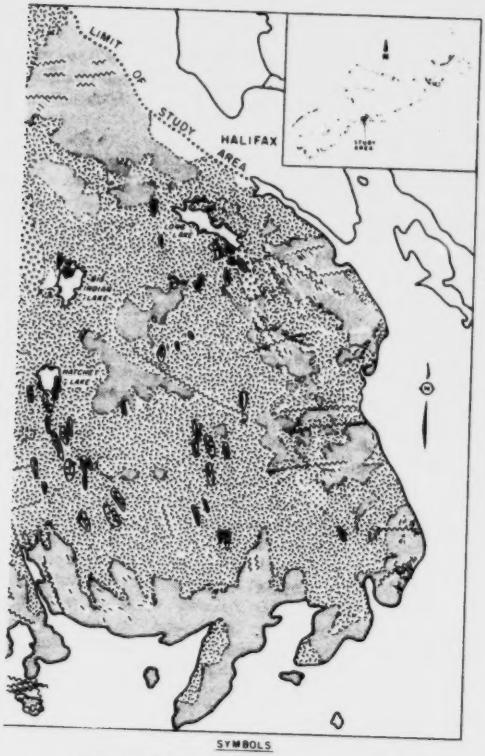

0 1 2 3 4 5 mi
0 1 2 3 4 5 6 7 8 km
LEGEND
ABLATION TILL washed sand, gravel, till, sedimentary structures common
GRANITE TILL (a) greyish orange, loose sandy till, frequently has a mantle of angular ablation boulders (b) drumlin facies, compact with relatively finer matrix 1 m + thick (c) till veneer, less than 1 m thick over bedrock
LAWRENCETOWN TILL (a) reddish-brown, moderately compact, sand-clay matrix (b) drumlin facies, sandier matrix (c) till veneer, less than 1 m thick over bedrock
ROCK glacially scoured, striated and polished Thin cover of residuum and vegetation

Figure 2. Surficial geology modified from Stea and Fowler (1979b) with supplementary airphotograph interpretation.



SYMBOLS

Glacial striations, sense of ice flow unknown

Terrace scarp

Ice abraded, linear bedrock ridges, whalebacks rocks moutonnee

Gradational contact between major till units

Gradational contact between till facies and minor surficial deposits

Kame

Kettle hole

Lineations, may or may not be structurally controlled, varying degrees of ice scour along structurally ? weakened zones

Major marginal ridge, minor moraine

Drumlin

Glacial meltwater channels (arrow indicates direction of flow)

Mineral prospects

Eskers (direction unknown)

Figure 2. Continued.

Whalebacks, Rock Drumlins and Roches Moutonnees

Whalebacks and rock drumlins are streamlined bedrock outcrops oriented parallel to ice flow. Roches moutonnées are bedrock outcrops with streamlined up-ice faces and truncated down-ice extensions with the long axis oriented parallel to ice flow.

Whalebacks are easily mapped using airphotographs. Peggys Cove (Fig. 2) is a classic area to view these erosional landforms. Rock drumlins are more difficult to distinguish using airphotographs. None were observed in the study area. Roches moutonnées are abundant in areas of bedrock outcrop (Fig. 2) and the presence of this feature indicates the moraine is thin (<1 m) and discontinuous.

Meltwater Channels

Meltwater channels may be recognized in airphotographs as U shaped channels cutting across topography, channels terminating above the present base level, abandoned channels, or channels occupied by misfit streams associated with fluvial terraces. Meltwater channels form by the erosion of flowing water at the base of a mass of glacial ice. The channels may be cut into bedrock or unconsolidated surficial materials. The channels generally (but not always) reflect the regional ice gradient. Meltwater channels may also be formed when water released by melting ice flows down the topographic gradient. An example is the meltwater channels near Upper Falmouth (Fig. 1).

Fluvial Terraces

Fluvial terraces form in response to eustatic changes in sea level, isostatic changes in land elevation, a combination of the above, or any other factor which changes the equilibrium gradient of the fluvial system.

Airphotograph interpretation reveals well developed terraces along the Upper Avon River (Fig. 1). The terraces probably relate to a Late Wisconsinan period of marine transgression followed by emergence and downcutting by the Avon River. This terrace forming event has been recognized by many workers along the north shore of the Minas Basin (Swift and Bornes, 1967; Wightman and Cook, 1978; Wightman, 1980; Stea, Finck and Wightman, 1984).

DEPOSITIONAL FEATURES-DEPOSITS

Drumlins

Drumlins are lobate hills with steep up-ice ends and tapered down-ice extensions. Sections through drumlins frequently reveal multiple till sheets in superposition. The till sheets may represent different glacial events or different directions of ice flow, or both. The long axis of the drumlin may not parallel the latest direction of ice movement in an area. The presence of drumlins or drumlin fields indicates the ground moraine is generally thick and continuous over bedrock.

Drumlins are widely scattered over much of the Halifax Peninsula (Fig. 2) and in the Wallaback - North Canoe Lake area (Fig. 1). Differentiation of granite till-veneered drumlins from Lawrencetown, Slate or Quartzite till-veneered drumlins is difficult using airphotographs. Granite drumlins are often more isolated than the latter drumlins.

Ablation Till

Variations in texture or facies (or both) within or between till sheets are difficult to recognize using airphotographs. Ablation till may be recognized by its general hummocky surface. Sandy, well drained tills favour the growth of deciduous vegetation recognized by light shades of grey on black and white airphotographs. Therefore, careful distinction must be made between sandy drumlins, well drained topographic highs and ablation tills.

Large boulder fields, distinguished from rock outcrop by the lack of structure or linear erosional features, are well developed south of Hubley Lake (Fig. 2) on the Halifax Peninsula. Recognition of these ablation boulders is important because they may represent englacial or supraglacial material which has been transported for kilometres.

Eskers

Eskers are long, narrow, sinuous ridges of poorly sorted sand and gravel. In areas of variable relief, eskers are usually found in valleys. Eskers paralleling the regional ice gradient may cut across topography. The direction of water flow may be determined by examining sedimentary structures such as pebble imbrication or the orientiation of foresets.

An esker complex is well developed near Grey Mountain (Fig. 1). It indicates an east-west orientation of ice flow. The actual direction of ice flow is not easily determined using airphotographs, though it may be inferred from related morphosequence.

Outwash

Outwash is deposited by meltwater from a retreating ice front. It forms flat, kettled and terraced gravel plains, often confined to valleys or the mouths of river valleys. The strong topographic control of outwash deposition "eliminates ground" and gives the airphotoghraph interpreter an idea where to expect deposition.

Sediment interpreted to be outwash is confined to the Avon River Valley (Fig. 1).

Overburden Thickness

The subdivision of an area on the basis of overburden thickness (i.e. the amount of till overlying bedrock) is important for bedrock mapping, geochemical surveys and engineering applications. Three main subdivisions which are common are rock, till veneer and till blanket. Contacts between these areas are extremely variable, gradational and are often strongly influenced by topography.

Rock

Areas of continuous rock outcrop (>50%), with isolated patches of till or residuum (or both) in depressions, are mapped as rock. Vegetation is restricted to low bushes with scattered trees in area of thin till.

Large areas of rock are found north of Millet Brook and west of Panuke Lake (Fig. 1). On the Halifax Peninsula, large rock areas are found near Peggys Cove, Pennant Bay, Frederick Lake, Birch Cove Lakes and Chebucto Head-Herring Cove (Fig. 2).

Till Veneer

Areas interpreted as having an average thickness of 1.6 to 4.9 feet (0.5 to 1.5 m) of till overlying bedrock are mapped as till veneer. Outcrop is common on bedrock ridges with thicker deposits of till between the ridges. Over fifty percent of the total area is commonly covered by vegetation. In areas where residuum is well developed, 100% vegetation cover may occur even though there is less than 1.6 feet (0.5 m) of till. In areas of till veneer, the bedrock topography controls the surface topographic expression and bedrock structural elements can often bemapped using airphotographs.

Till Blanket

Areas with continuous till cover and only minor bedrock outcrop are mapped as till blanket. Vegetation cover is generally continuous. In these areas bedrock relief or, more commonly, the relief of glacial depositional features (or both) may control the surface topography. Large scale depositional features, such as drumlins and moraines (Figs. 1 and 2) and subdued to absent bedrock structure, generally indicate a thick till blanket.

CONCLUSION

Major features of glacial erosion and deposition may be accurately mapped using airphotographs. However, small scale erosional and depositional features cannot be mapped using airphotographs.

Detailed investigation of individual surficial deposits and their relationships to a stratigraphic framework must be determined by detailed field mapping. As such, this paper and the accompanying figures will serve as a basis for detailed field mapping which will be done during the 1985 field season as part of the South Mountain Batholith Project.

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DEEP DIAMOND-DRILL HOLE AT WEST GORE, HANTS COUNTY, A PRELIMINARY LOOK

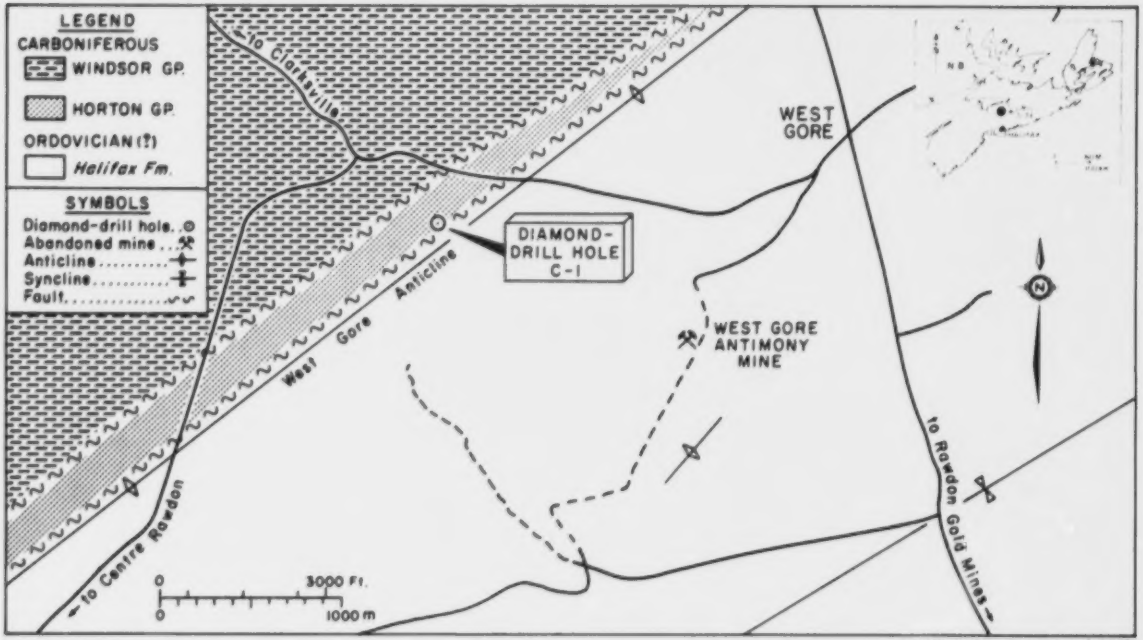
P. K. Smith

Diamond-drill hole C-1 was completed by the Nova Scotia Department of Mines and Energy at Clarksville, Hants County (NTS map sheet 11E/04; Fig. 1) to gain geological information regarding further delineation of the known antimony mineralization at West Gore. The vertical drillhole was spotted to intersect Early Carboniferous Horton Group and Cambro-Ordovician Halifax and Goldenville Formations. From existing geological mapping in this area a reconstructed cross-section (Fig. 2) suggested that the Halifax Formation would be intersected along the northern limb of the West Gore Anticline at about 300 feet (91.5 m) and would subsequently be underlain by sandstones of the Goldenville Formation at about 600 feet (183 m). The following is a brief account of what was encountered to a depth of 2,121 feet (646.5 m) with a more detailed description to follow.

Glacial overburden at this location is about 33 feet (10 m) thick. The Horton Group stratigraphy consists of fine- to coarse-grained arkosic sandstone with laminated dark to light coloured fossiliferous shales and mudstones. Plant fossils are common throughout and locally coaly material occurs in beds up to 0.4 inches (1 cm) thick. Small sulphide lenses of pyrite and pyrrhotite are common throughout the shales and mudstones. Bedding is inclined at about 20-30° to the core axis at the top of the Horton section, but increases to 50-60° near the base of the section intersected at 330 feet (100 m). The amount of graphitic shearing and faulting also increase towards the base of the Horton Group strata.

The base of the Horton in this hole is in fault contact with underlying highly sheared black graphitic slates of the Halifax Formation. The Halifax Formation consists predominantly of black slate with interbedded dark grey to grey slate with minor fine grained grey sandstones. Bedding intersections with the core indicate the strata are horizontal and there is an absence of any slaty cleavage. Flattened sulphide lenses of mixed pyrite and pyrrhotite occur along the bedding laminations. Disseminated euhedral to subhedral zoned pyrite crystals are also common throughout. Locally, thin stringers of pyrite crosscut the bedding. Total sulphide content constitutes up to 10 per cent of the core material.

Several crosscutting quartz veins up to five inches (12.5 cm) thick show extensive evidence of postemplacement shearing. Although shearing is extensive throughout the Halifax Formation at West Gore, two major sets are evident in this hole. One dips about 30° to the horizontal beds; the second is parallel to the bedding laminations. The first set occurs as narrow crush zones and may not represent significant displacement. The second set is extremely pervasive occurring along many bedding surfaces causing strong slickensiding and graphite development. At present the existence of this horizontal graphitic shearing is not easily explained considering the hole is located at the apex of an apparent



modified after Stevenson (1955)

Figure 1. Geology around diamond-drill hole near the West Gore antimony mine.

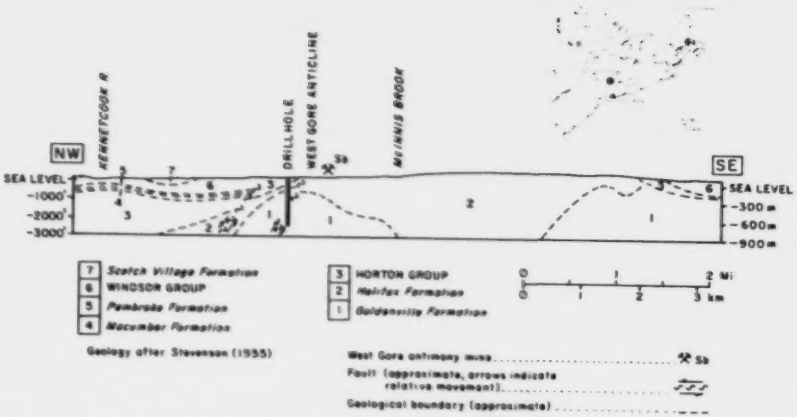


Figure 2. Northwest-southeast cross-section through the West Gore antimony mine site showing the location of the drillhole.

upright anticlinal fold. The lack of an upright slaty cleavage in the Halifax Formation as well as the fact that the Goldenville Formation was not encountered is curious. No antimony mineralization has been observed yet, but much of the drill core has still to be carefully examined.

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MYLONITIZATION AND FLUIDIZED BRECCIATION IN SOUTHERN NOVA SCOTIA

P. K. Smith

INTRODUCTION

An examination of diamond-drill core along the southwestern contact of the South Mountain Batholith has revealed an extensive deformation zone. This zone, as defined by drill intersections, is located one mile (1.6 km) north of Rushmere and Moosefly Lakes, Yarmouth County and five miles (8 km) southeast of the East Kemptville tin mine. This complexly sheared and fluidized zone varies in width from tens to hundreds of metres attaining a maximum width of about 0.93 miles (1.5 km). The zone strikes east-northeast and appears to have a steep dip. The maximum strike extension has yet to be defined, but exceeds 6.2 miles (10 km) based on drill intersections (Fig. 1). A narrow central section within this zone shows maximum cataclastic affects.

GENERAL GEOLOGY

The rock units noted in the study area include Cambro-Ordovician metamorphosed sandstones, siltstones and shales of the Goldenville Formation near its contact with the Halifax Formation. These rocks were regionally metamorphosed under Pyrenean P-T conditions (Chu, 1978) and intruded by the granitoid South Mountain Batholith during the Devonian Acadian Orogeny (Taylor and Schiller, 1966; Fairbairn et al., 1960).

Local Geology

The area examined lies within the sillimanite metamorphic zone of Keppie and Muecke (1979). However, biotite, minor garnet and poorly preserved cordierite (Fig. 2a) are the only metamorphic minerals observed in any of the drill core. The occurrence of a thin garnet-quartz-carbonate coticule horizon in drillhole 82-33 would suggest that the stratigraphic level here is very near the Halifax-Goldenville contact. Similar mineralogy is observed at this stratigraphic horizon in Guysborough County (Smith, 1983). Primary sedimentary structures such as bedding and flame structures (Fig. 2b) are well preserved in areas where the rocks have not been affected by intense deformation.

The granitoid rocks exposed in the drill core are mainly monzogranite in composition with lesser amounts of syenogranite and quartz monzogranite (Fig. 3). Muscovite is the dominant mica although biotite is also equally common in most rocks. The total mica content averages about five per cent. Accessory and secondary minerals are not common but include, sphene, apatite, zircon, sericite, epidote, minor opaques and chlorite. Sphene occurs along sericitic fractures in some specimens. Small xenoliths are locally present. The colour of the granitoid rocks is generally whitish although narrow, pinkish orange sections with apparent gradational contacts occur.

Subequigranular phaneritic monzogranite shows the least alteration of all rock types. Individual euhedral to subhedral crystals

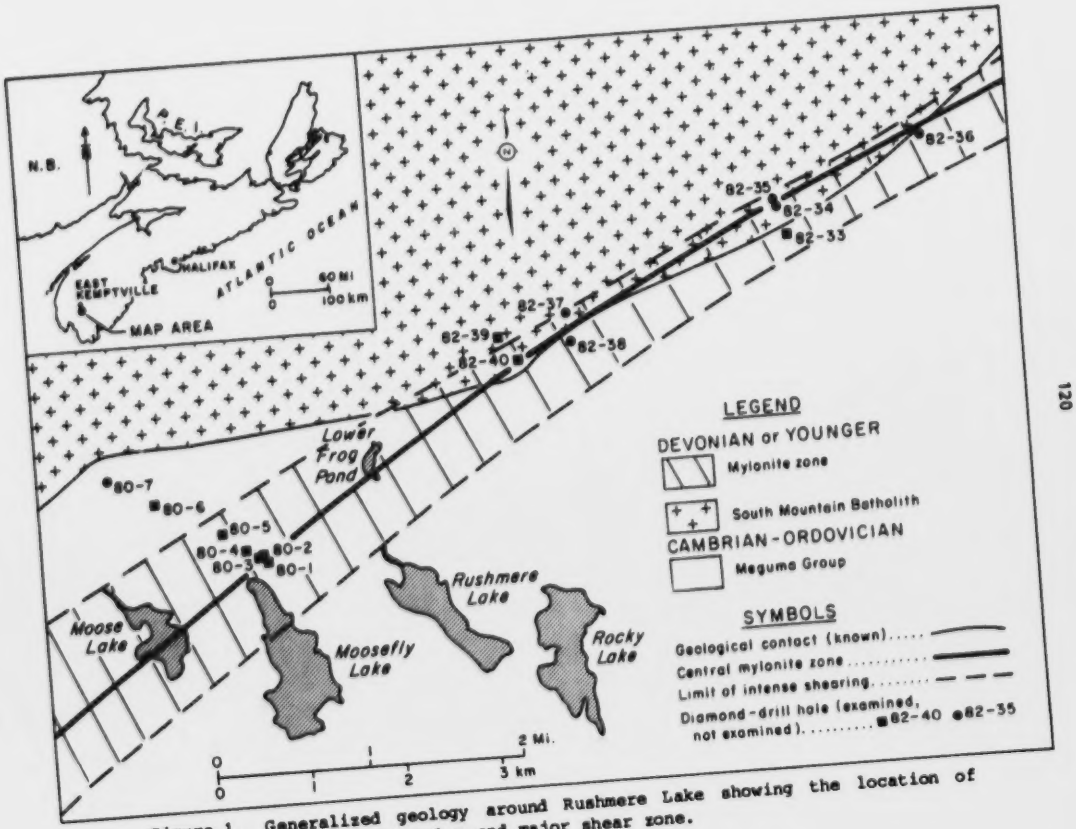

Figure 1. Generalized geology around Rushmere Lake showing the location of diamond-drill holes and major shear zone.

have interlocking grain boundaries locally. Inclusions of alkali feldspar in plagioclase is common as is plagioclase in alkali feldspar. Some slightly larger crystals display roughly equal proportions of mineral content. Quartz is irregular and fills interstitial spaces as well as secondary veinlets.

Megacrystic monzogranite have rapikivi and anti-rapikivi feldspar textures, although the megacrysts are more distinctly monomineralic. Smaller grains are subhedral to anhedral. Concentric zonation is common in many plagioclase megacrysts as is albite and pericline twinning.

Altered megacrystic monzogranite and syenogranite show selective potassium alteration. Many megacrysts as well as finer grained matrix grains have been replaced by alkali feldspar. In some crystals plagioclase cores are still preserved. Alkali feldspar megacrysts have diffuse grain boundaries with small irregular quartz grains concentrated near the margins. Locally some megacrysts have a core of alkali feldspar with dissiminated plagioclase surrounded by a rim of either pure plagioclase or, more commonly, plagioclase with quartz inclusions. Perthitic textures are widespread throughout most rocks types.

Megacrysts range in size up to five centimetres. Locally, finer grained monzogranite dyke rocks crosscut other rock types.

Deformation Zone

Both metasedimentary and granitoid lithologies are strongly deformed in this zone. The intensity of deformation increases dramatically towards the central part of the zone. Deformed rocks include mylonite, blastomylonite, microbreccias, fluidized fault breccias and their silicified equivalents. Fluxion textures and C/S fabrics are common. The sequential development along this zone begins with the formation of mylonitic rocks followed by fluidization brecciation, and ends with pervasive silicification which produced extensive quartz stockwork, and silicification of mylonitic and brecciated rocks. This sequence postdates the regional static metamorphism of the Devonian Acadian Orogeny.

Within this zone all strata are not deformed homogeneously. Small strain windows up to 10 metres thick have not been deformed and preserve earlier features. Pronounced dutile shear fabrics similar to those observed in Guysborough County (Smith et al., 1985) are widespread in the metasedimentary strata and are locally developed in the granitoid rocks. Mylonites (Fig. 2c) and blastomylonite (Fig. 2d) textures occur across the zone in metasediments as thin horizons averaging 1-2 cm in width. Individual laminae are 40 μ (0.04 mm) wide and are composed of more finely crushed quartz and sericite. Porphyroclasts range in size from 0.08 to 0.4 mm. Thinly laminated colour bands composed of cryptocrystalline material help define the mylonite fabrics. These colour bands are composed of interlayered sericite, quartz and chlorite. Some chlorite may be secondary growth along fluxion textures in mylonites. The mylonitic porphyroclasts are composed mainly of recrystallized quartz aggregates. Thin microbreccias usually occur adjacent to mylonites. The average fragment size of the microbreccias are 0.3 mm with quartz being the dominant constituent. Fragments of mylonite, with cryptocrystalline

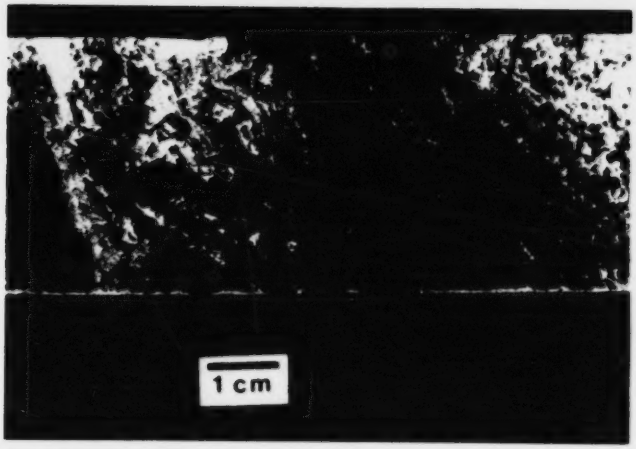

Figure 2a. Cordierite-bearing semipelite. Cordierite is poorly preserved in this fluidized breccia zone. Fragment colour varies from light green to reddish-brown.

Figure 2b. Biotite porphyroblasts in thinly bedded relatively undeformed turbidite sequence. Flame structure preserved in overlying sandstone bed.

Figure 2c. Thinly banded mylonite showing small drag fold and development of widely spaces c plane. Later crosscutting fluidization breccia encloses randomly oriented mylonite fragments and other foreign material.

Figure 2d. Thin zone of fine blastomylonite with parallel fluidization breccia zones (white) and later crosscutting fluidized breccia (dark).

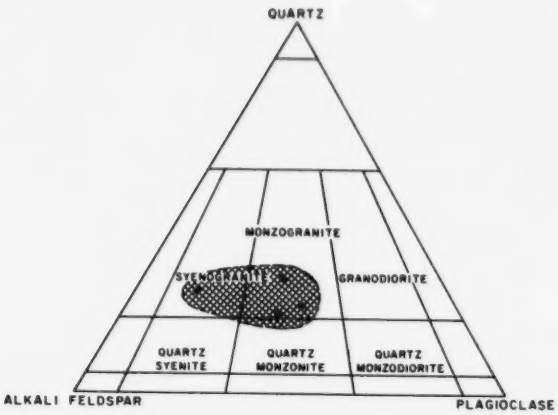

Figure 3. Modal mineralogy of some of the granitoid rocks examined from diamond-drill core from the Rushmere Lake area along the southwestern contact of the South Mountain Batholith (fields after Streckeisen, 1976).

textures similar to ultramylonite, are locally common in some of the mylonite strata. This is suggestive of a prolonged or repeated period of mylonitic deformation. Many of these light green to reddish brown mylonites display pseudosedimentary layering (Fig. 4d). Minor folds of mylonite (Fig. 2c) are not common in the diamond-drill core examined but do suggest continued tectonic activity subsequent to mylonite development. C/S fabrics (Ponce DeLeon and Choukroune, 1980) similar to those of the Lundy Shear zone (Keppie, personal communication) have also deformed these mylonites. It is generally accepted that mylonites and C/S fabrics are produced by ductile deformation (Bell and Etheridge, 1973).

Following this ductile deformation an episode of fluidization brecciation (Figs. 2c, 4a, 4b, 4c) occurred along the entire zone fragmenting previously developed mylonitic rocks as well as metasedimentary host rocks. These breccias occur as stockwork veins up to several centimetres in width with many showing repeated injection along the same vein. Besides randomly oriented host rock fragments these breccia veins consist of quartz and minor plagioclase with abundant secondary epidote, sericite and chlorite resulting in colour variation of light green, beige and orange to brown. Argillic alteration is common in some veins. Breccia fragments have variable size up to about one centimetre and locally the fragments are distinctly bimodal consisting of mylonite and sedimentary host rocks. Epidote occurs as both euhedral crystals averaging 0.5 mm and interstitial amorphous material. Quartz crystals generally show good crystal faces characteristic of anisotropic crystal growth in fluid-filled fractures (Cox and Etheridge, 1982). Local, crosscutting relationships between breccia veins suggest at least two episodes of fluidization brecciation subsequent to mylonite development. These stockwork breccia veins also display several preferred orientations relative to the core axis.

The final stage in the development of this zone is pervasive silicification producing thin quartz stockwork throughout the zone (Figs. 5a, 5b) and silicification of many host rock lithologies including both sedimentary and granitoid rocks. The veins crosscut the fluidization breccias (Fig. 5b) and mylonitic strata.

Silicification is most intense along the central part of the zone (Fig. 1). Along this zone fluidization breccias are most common. They have been pervasively silicified and many internal structures have been destroyed by recrystallization. These silicified breccias (Figs. 5c, 5d, 6a) also contain a high content of white clay (Fig. 6b). Colour variation along this part of the zone is light green, beige, mauve and light to dark brown with shades of orange. This very resistant rock horizon has been referred to as a "quartz-kaolinite dyke" by exploration geologists working in the area.

In thin section most of the quartz occurs as interlocking anhedral microcrystalline grains averaging 30 μ (0.03 mm) in diameter. Amorphous clay forms interstitial filling between many grains. Thin stockwork quartz veins, frequently showing gradational contacts with the silicified wall rock, are pervasive throughout the examined drill core. Maximum crystal size, attained along the centres of these veins, is 0.5 - 1.0 mm. Chlorite veinlets observed in the fluidized breccias are absent throughout this zone having been apparently replaced by quartz.

This silicified horizon appears to be the approximate locus of this mylonitic zone and forms the diagnostic rock type used to trace the strike extension of this ductile shear zone.

The regional implications of this ductile shear zone are profound. Ductile shear in the Meguma Group adjacent to the Minas Geofracture (Smith et al., 1985) is attributed to major wrench faults which separate the Avalon and Meguma terranes (Keppie, 1977). Deformation resulting from movement along the Minas Geofracture is less intense than that observed in the Rushmere Lake area. Relative movements along the Minas Geogracture during Devono- Carboniferous times may be as great as 248.6 miles (400 km) (Bujak and Donohoe, 1980). Although in the area there are no obvious marker horizons crosscut by this zone to document relative displacement, Robertson (1983) suggests there could be in excess of 62 miles (100 km) movement on a zone of this width. However, he states that his calculations may not be reliable for large shear zones. It is therefore imperative that further regional investigations be conducted to document the full extent of this major shear zone.

Mineralization

The Rushmere Lake area initially stimulated interest because of a Sn-W anomaly resulting from lake sediment geochemistry (Rogers and MacDonald, this volume). This anomalous area, which is separate and possibly distinct from the geochemical anomaly associated with the East Kemptville tin deposit, could hold potential for similar mineralization along the south contact of the Batholith. For this reason existing diamond-drill core from near the anomalous zone was re-examined. Minor scheelite mineralization was located in drillhole No. 82-33 at 33.1 m depth in a thin spessartine garnet-bearing coticule horizon (Fig. 6c). This

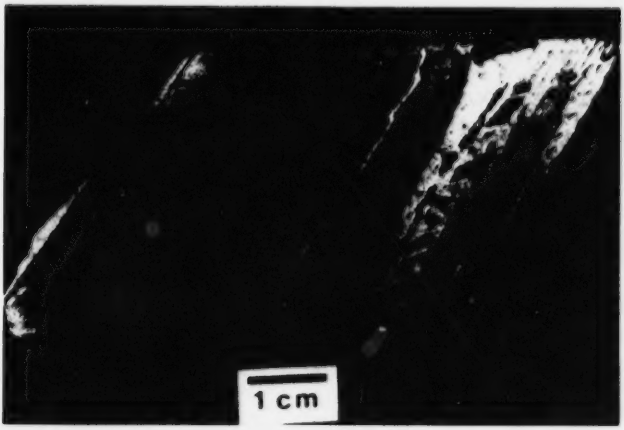

Figure 4a. Biotite-bearing pelite with thin fluidized breccia zone showing randomly oriented wall rock fragments.

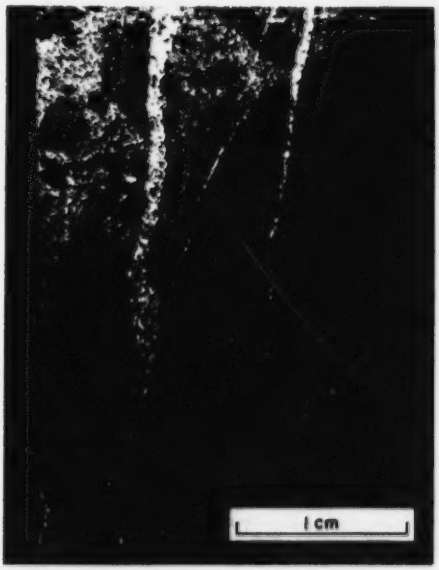

Figure 4b. Fluidization breccia zone with bimodal populations of randomly oriented fragments. Thin crosscutting quartz veinlets displays several orientations.

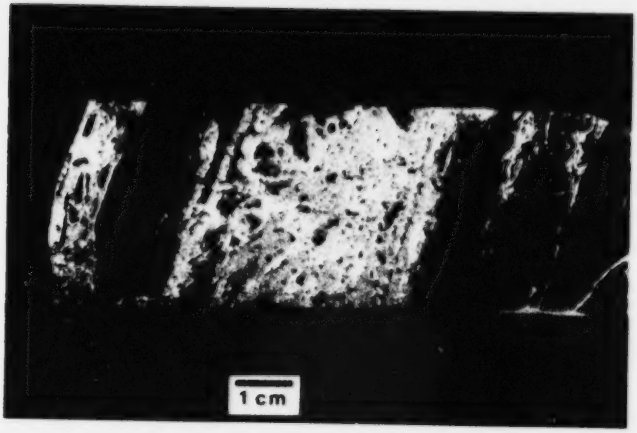

Figure 4c. Fine grained biotite-bearing psammite with stockwork fluidization breccia. Randomly oriented local and foreign fragments present.

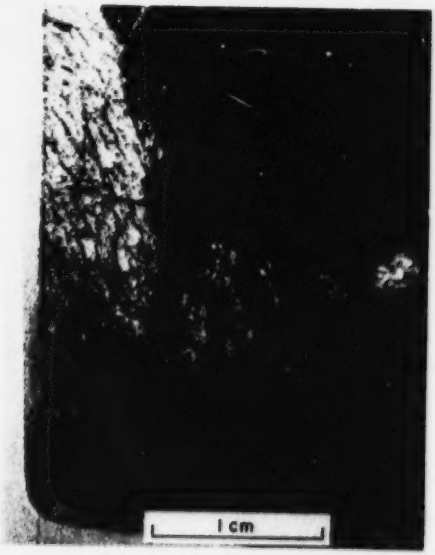

Figure 4d. Psammitic mylonite with poorly developed C/S fabric crosscut by dark blastomylonite exhibiting pseudosedimentary stratification and infill structures.

Figure 5a. Fluidization breccia containing both local and foreign randomly oriented fragments. Breccia has been flooded by silica now forming much of the matrix and crosscutting veins.

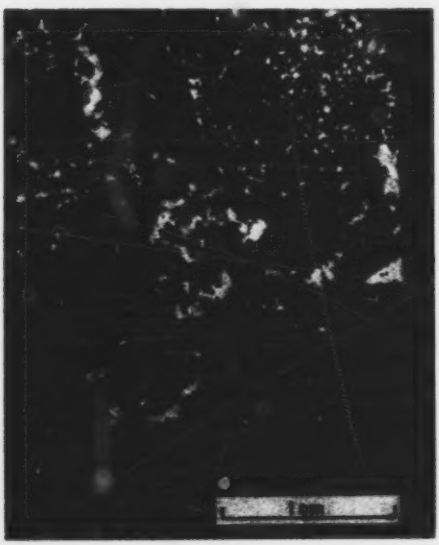

Figure 5b. Quartz stockwork cutting dark mylonitic band at a high angle.

Figure 5c. Silicified fluid breccia. Dark matrix material and light fragments have almost totally been replaced by quartz.

Figure 5d. Silicified fluid breccia. Sedimentary and tectonic rock fragments have been almost totally replaced by quartz. Colour variation caused by minor clay and sericite.

Figure 6a. Fluidization breccia showing moderate silicification of locally and foreign derived fragments. Thin fine grained quartz veins fill fractures in rock fragments.

Figure 6b. Quartz/kaolinite breccia. One half shows moderate clay development as dark matrix around fragments while the other half of the silicified breccia has been unaffected.

Figure 6c. Spessartine-quartz-carbonate coticule horizon. Scheelite occurs in this section but is extremely fine grained (cross-nicols).

mineralized horizon is presumed to lie near the manganese-rich Halifax/Goldenville Formation boundary. This stratigraphic portion is known to contain tungsten mineralization in other parts of the Province (Chatterjee, 1983; Shaw, 1981). No other mineralization was observed in the core. However, geochemical analysis of collected material has not yet been completed.

At present it is reasonable to assume that the observed mineralization is restricted to the specialized stratigraphic horizon near the Halifax/Goldenville boundary and that there was no significant mineralizing event relating to the formation of this mylonite/fluidized breccia zone. However as a zone of preferential fluid migration, this ductile shear zone may be mineralized elsewhere along its strike, depending on the local character of the fluids and wall rocks. As such, the shear zone is an interest for mineral exploration.

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GEOCHEMICAL VARIATION WITHIN A GRANITIC TERRANE DISPLAYING ANOMALOUS AIRBORNE RADIOMETRIC SIGNATURE FROM EASTERN NOVA SCOTIA

G. A. O'Reilly

INTRODUCTION

The Sangster Lake and Larrys River Plutons of eastern Nova Scotia were mapped as part of the Meguma Project of the Canada-Nova Scotia Co-operative Mineral Program 1981-1984 in the 1983 field season (O'Reilly, 1984; Fig. 1). Thirty-three samples from these Plutons were petrographically studied and analyzed for major and trace elements. The analyzed trace element suite consisted of Ba, Rb, Sr, U, Th, Sn, W, Mo, Cu, Pb, Zn, F, B, Li, Be, Zr, Ag and Au. Computer manipulation of the data and microprobe studies of mineral phases are nearing completion.

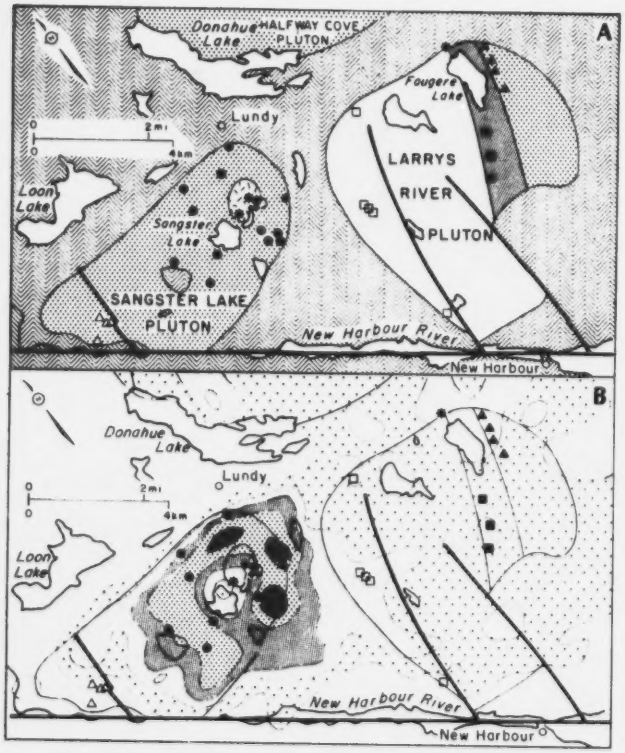
The Sangster Lake Pluton is a granitic terrane located in the Meguma Zone of Nova Scotia which has anomalous airborne radiometric signature for eU (equivalent uranium) and eU/eTh. Ford and Ballantyne (1983) determined by reconnaissance lithogeochemistry that some samples from the Sangster Lake Pluton have enrichment or specialization in granophile elements. They also recognized an **ablitization trend** in the Sangster Lake Pluton which corresponds to an increase of the Na_2O/K_2O ratio with respect to increasing U. In this study, samples of the Sangster Lake Pluton (anomalous radiometric signature for eU) and the adjacent Larrys River Pluton (average airborne radiometric signature) were selected to represent all observed textural and compositional phases of the Plutons and to include all regions from lowest to highest airborne eU response (Fig. 1).

It is a prime aim of this study to firmly establish the relationship between granitic rocks of anomalous airborne radiometric response and significant major and trace element variations. Chatterjee and Muecke (1982) and Ford and Ballantyne (1983) stressed this point in recognizing an important correlation between granitic rocks of anomalous radioelement content and significant granophile element specialization in the Meguma Zone.

SAMPLE SELECTION PROCEDURE

Figure 1 shows a comparison of the Geological Survey of Canada airborne radiometric data (compiled from 1 km line spacing surveys) with geology of the Sangster Lake and Larrys River Plutons. The geochemical sample locations are indicated on both the geological and radiometric maps and have been separated according to rock type as well as radiometric response. The geology and phase delineation used in Figure 1 has been updated from O'Reilly (1984) and is based on field mapping, detailed petrography and geochemical data. The Larrys River Pluton has a constant and low radiometric response so its sample groupings are based on mapped phases consisting of porphyritic biotite monzogranite, transitional monzogranite, two-mica monzogranite and leucomonzogranite.

Canada-Nova Scotia Co-operative Mineral Program 1981-84
Mainly funded by Province of Nova Scotia



GEOLOGICAL LEGEND
MAP A

DEVONO-CARBONIFEROUS
- Leucomonzogranite
- Two mica monzogranite
- Transitional monzogranite
- Biotite monzogranite

CAMBRO-ORDOVICIAN
MEGUMA GROUP
- Quartzite, metawacke, slate, schist

AIRBORNE RADIOMETRIC LEGEND
MAP B
eU (equivalent uranium) ppm
- >6
- 5-6
- 4-5
- 3-4
- 2-3
- <2

SAMPLE LOCATION SITES

Sangster Lake Pluton
- △ Primitive monzogranite
- ● Central monzogranite
- ◉ High response monzogranite
- ● Leucomonzogranite
- ✦ Greisen

Larrys River Pluton
- □ Porphyritic monzogranite
- ■ Transitional monzogranite
- ▲ Muscovite-biotite monzogranite

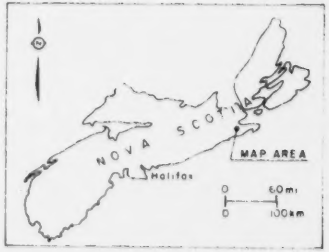


Figure 1. Comparison of the geology of the Sangster Lake and Larrys River Plutons (Map A) with Geological Survey of Canada airborne radiometric data for equivalent uranium (Map B). Locations of chemically analyzed samples are indicated.

The Sangster Lake Pluton consists of two main rock types, monzogranite and leucomonzogranite. Within the monzogranite there is highly variable radiometric response in the airborne survey data (Fig. 1). To accommodate this variation in designating sample groups this monzogranite phase has been subdivided into three categories based on radiometric response: primitive monzogranite (n=4 samples), central monzogranite (n=7 samples) and high response monzogranite (n=4 samples). The primitive monzogranite has low radiometric response, similar to that over the Larrys River Pluton (2-3 eU ppm). The central monzogranite underlies the central and northern regions of the Pluton. The airborne radiometric response level of the central monzogranite (3-6 eU ppm) is elevated by two to three times that of the primitive monzogranite and Larrys River Pluton rocks. The high response monzogranite subgroup consists of a suite of four samples from the region of highest airborne radiometric response (5-6.6 eU ppm) located on the southern border of the Pluton. The leucomonzogranite subgroup consists of samples of the Beans Lake leucomonzogranite plug within the Sangster Lake Pluton and also some similar, but smaller intrusions from the Sangster Lake and Larrys River Plutons. One sample of greisenized monzogranite from the contact zone of the Beans Lake plug with the central monzogranite is also included.

Petrographic studies have shown that the central and high response monzogranite samples have undergone considerable deuteric or subsequent postcrystallization alteration. Breakdown of both potassic and plagioclase feldspar to quartz and white mica has resulted in these rocks containing up to 15-16% modal muscovite (Fig. 2). This alteration is progressive within the Sangster Lake Pluton rocks and is a petrographic indicator that the monzogranite of the anomalous regions has undergone a significant change from a so called average monzogranite.

SUMMARY OF MAJOR AND TRACE ELEMENT DATA

The geochemical data (n=33 samples) represent the major subdivisions identified by petrograpy and radiometric response. The data set was treated statistically to produce Spearman Rank Correlation Coefficients (SPSS). This nonparametric statistical method was used to determine interelement relationships. Spearman Rank Correlation Coefficients of the total major and trace element data (Fig. 3) have defined a positive granophile interelement association of 99.9% significance (U, Sn, Rb, Be, P_2O_5, Na_2O, Li and F). In contrast the elements of this defined granophile suite have a negative correlation with such elements as K_2O, Th, Pb, Ba and Sr. The observed positive and negative interelement relationships have significance when compared with the geological and petrographic data.

Figure 4 shows some selected plots of the major and trace element data according to subgroup. The central and high response monzogranite and the leucomonzogranite are consistently higher in granophile element content when compared to the lower response regions of the Sangster Lake and Larrys River Plutons. Data fields from other Meguma Zone granitic rocks are plotted for comparison and further define the specialized nature of the highly radiometric region of the Sangster Lake Pluton. The geochemical trends for K_2O, Na_2O and P_2O_5 are of particular interest. Ford and Ballantyne (1983) recognized, with reconnaissance lithogeochemistry, what they termed an albitization trend in these Plutons. This trend corresponds

Figure 2a. 'Albite (Ab^{95-100}) altering to titanium-poor muscovite (m). High response monzogranite, Sangster Lake Pluton.

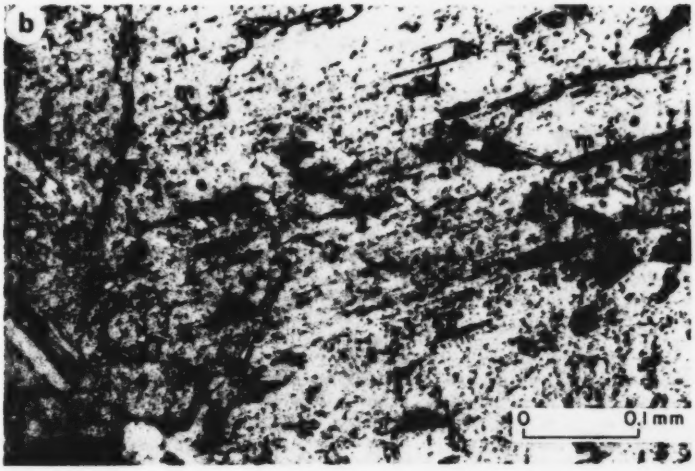


Figure 2b. Albite altering to muscovite (m) and apatite (a). High response monzogranite, Sangster Lake Pluton.

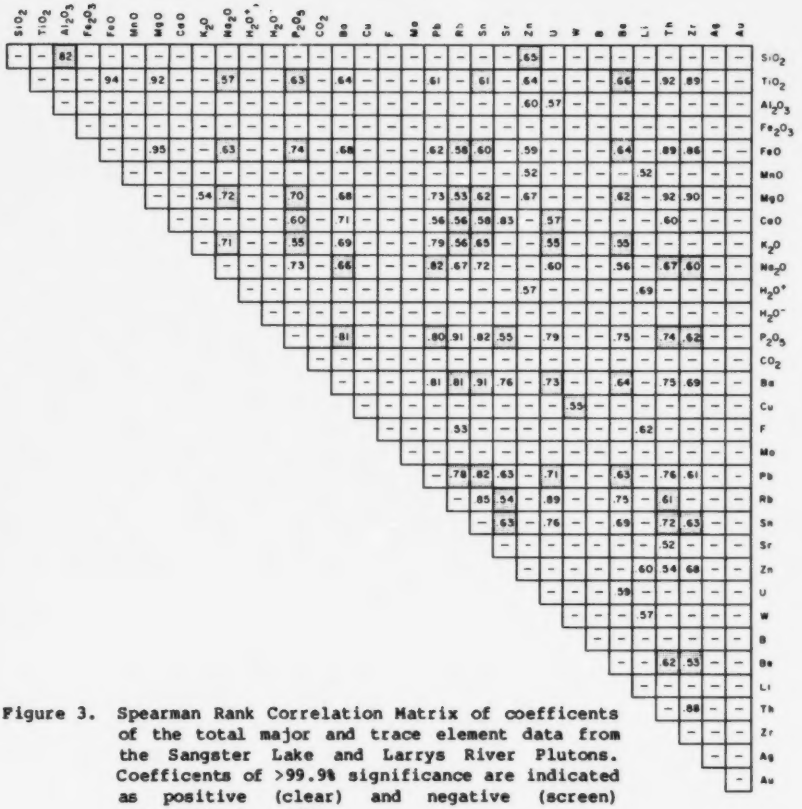

SiO2 TiO2 Al2O3 Fe2O3 FeO MnO MgO CaO K2O Na2O H2O+ H2O- P2O5 CO2 Ba Cu F Mo Pb Rb Sn Sr Zn U W B Be Li Th Zr Ag Au
SiO2 TiO2 Al2O3 Fe2O3 FeO MnO MgO CaO K2O Na2O H2O+ H2O- P2O5 CO2 Ba Cu F Mo Pb Rb Sn Sr Zn U W B Be Li Th Zr Ag Au

Figure 3. Spearman Rank Correlation Matrix of coefficents of the total major and trace element data from the Sangster Lake and Larrys River Plutons. Coefficents of >99.9% significance are indicated as positive (clear) and negative (screen) correlations. n=33.

to an increase of the Na_2O/K_2O ratio with respect to increasing U. The data from this study confirm existence of this albitization trend and define an increase of the Na_2O/K_2O ratio within the higher radiometric regions of the Sangster Lake Pluton (Figs. 1 and 4). A decrease of K_2O and increase of Na_2O contrast with defined magmatic differentiation trends for calc-alkalic magmatic suites (Gribble, 1969). The albitization trend is best shown by the K_2O–Na_2O–CaO plot (Fig. 4) in which the primitive monzogranite of the Sangster Lake Pluton and the monzogranites of the Larrys River Pluton occupy a position similar to the fields of monzogranites of the South Mountain and Musquodoboit Batholiths. The central monzogranite, the high response monzogranite, and the leucomonzogranite of the Sangster Lake Pluton reflect a Na_2O enrichment and trend away from the other monzogranitic fields.

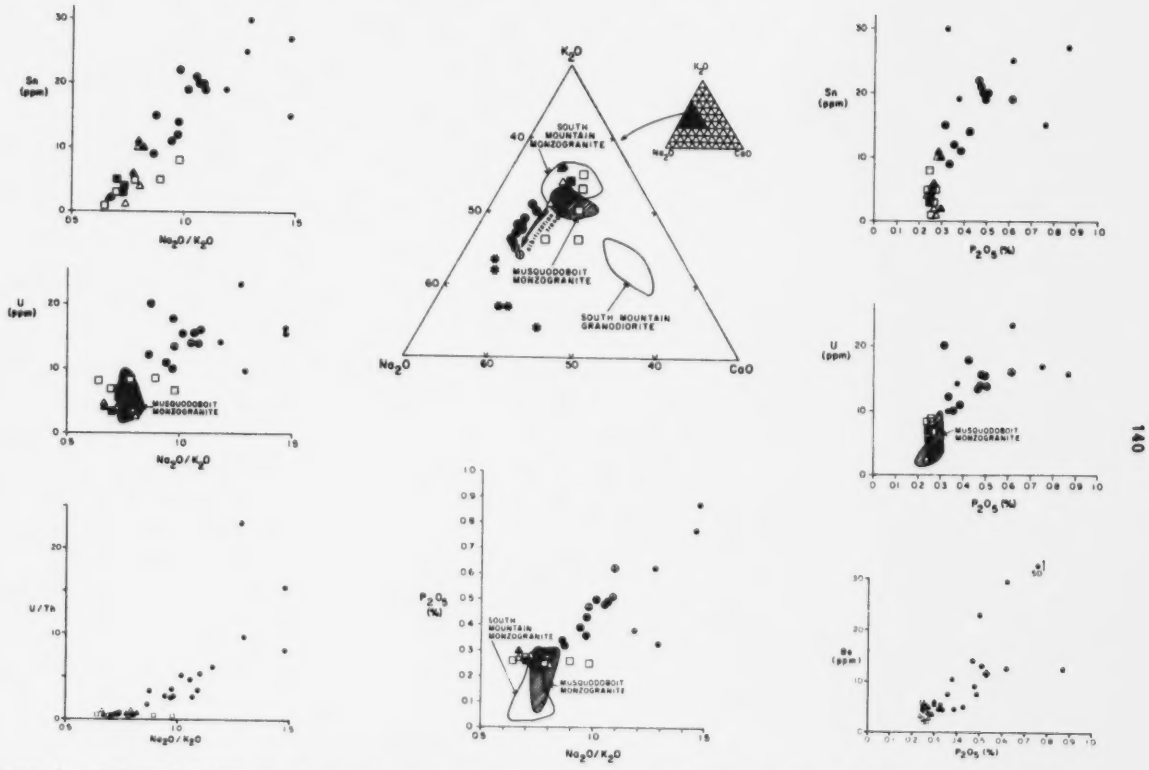


Figure 4. Selected plots of major and trace element data from the Sangster Lake and Larrys River Plutons. Symbols are according to subgroupings indicated on Figure 1. Fields for the South Mountain and Musquodoboit Batholiths are after McKenzie and Clarke (1975) and MacDonald and Clarke (in preparation) respectively.

The pronounced increase in P_2O_5 content corresponding to the higher response rocks of the Sangster Lake Pluton also conflicts with expected differentiation trends for acidic magmatic rocks. P_2O_5 generally decreases with increasing differentiation (Gribble, 1969). Ford and Ballantyne (1983) identified in a Sangster Lake Pluton sample that chlorine-bearing apatite and uranium-bearing Fe-phosphate contain the highest concentrations of uranium. Alteration of albitic plagioclase within the high response monzogranite of the Sangster Lake Pluton has produced titanium-poor muscovite and abundant discrete grains of apatite (Fig. 2). With this progressive alteration of the plagioclase the modal amount of apatite within the rocks is significantly increased and has resulted in the observed increase in P_2O_5 content. Increase of P_2O_5 is therefore believed to be an indicator of the alteration processes. A positive correlation of P_2O_5 with U, Sn and other granophile elements (Figs. 3 and 4) suggests enrichment of these granophile elements is also associated with this progressive alteration. It follows that radioelement content, as observed in lithogeochemical sampling or inferred by airborne gamma ray spectrometric surveys, can indicate regions of granitic rocks specialized in granophile elements.

Other interesting major and trace element trends were observed, but only some were discussed here. Microprobe studies of feldspars, phyllosilicates and trace minerals are continuing and probably will reflect the progressive alteration observed in petrography and whole rock geochemistry.

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THREE PERMO-CARBONIFEROUS Rb/Sr AGE DETERMINATIONS FROM THE SOUTH MOUNTAIN BATHOLITH, SOUTHWESTERN NOVA SCOTIA*

G. A. O'Reilly, G. Gauthier** and C. Brooks**

ABSTRACT

The peraluminous granitic rocks of the Meguma Zone of mainland Nova Scotia consist of the large composite South Mountain Batholith (3,861 square miles; 10 000 km^2) and a number of smaller satellite plutons. The granitic rocks define a cogenetic suite ranging in composition from tonalite to leucogranite with granodiorite and monzogranite the predominant phases. Isotopic age determinations by a variety of methods and laboratories have determined the bulk of the granitic plutonism to be in the interval 365 to 380 Ma. This agrees with the observed stratigraphic position of the granitic rocks. Consistently though, Permo-Carboniferous apparent ages (260 to 340 Ma) have been reported as part of these studies. Many of these younger dates are commonly associated with granitic rocks from significant Sn-U mineralizations. The implication of a Hercynian magmatic and thermotectonic event, or both, in Nova Scotia with economic significance is evident but poorly defined.

New Rb/Sr radiometric data are presented for samples from three Sn-U type prospects hosted by the South Mountain Batholith. At the Long Lake and Westfield prospects, Rb/Sr whole rock isochron plots of samples from minor intrusions yielded apparent ages of 332 ± 10 and 270 ± 14 Ma respectively. A Rb/Sr mineral age determination on a muscovite separate from greisen at the Lake Darling occurrence yielded a 281 ± 5 Ma apparent age. The 332 Ma Long Lake age may conceivably be related to intrusion of a very latest stage phase of the Middle Devonian cogenetic suite comprising the South Mountain Batholith. The Westfield and Lake Darling 270 and 281 Ma apparent ages and other similar data by previous workers infer a Hercynian period of intrusion or at least thermotectonic activity pervasive throughout much of southwestern Nova Scotia.

INTRODUCTION

In Nova Scotia the area south of the Cobequid-Chedabucto Fault zone is known as the Meguma Zone (Williams, 1978; Fig. 1). This area has been the focus of intensive exploration activity for deposits of Sn, U and related elements since 1975. The exploration activity has renewed detailed geological studies of the granitic rocks by industry, governments and academic institutions.

The Meguma Zone consists of a sequence of metasedimentary and metavolcanic rocks of Cambrian-Early Devonian age and a peraluminous suite of Devono-Carboniferous granitic rocks (Fig. 1). The metamorphic rocks consist predominantly of a deep sea turbidite sequence, the Cambro-Ordovician Meguma Group. These rocks are overlain conformably by

*Funded by Province of Nova Scotia
**Departement de Geologie, Universite de Montreal, Montreal, Quebec

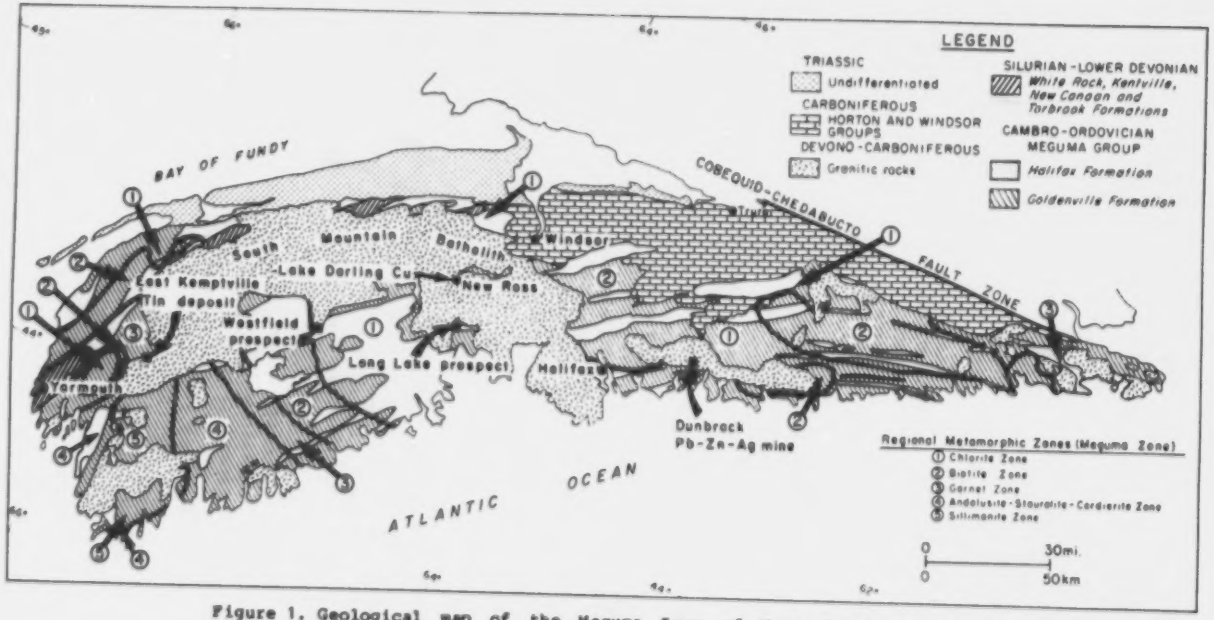

Figure 1. Geological map of the Meguma Zone of Nova Scotia including locations of mineral deposits discussed in this paper.

alkaline and tholeiitic volcanics and shallow water sediments of the White Rock, and Kentville, New Canaan and Torbrook Formations. For a more detailed description of the geology and evolution of the Meguma Zone, readers are referred to Taylor (1967, 1969), McKenzie and Clarke (1975), and Keppie (1977).

AGE OF THE GRANITIC ROCKS OF THE MEGUMA ZONE

The age of most of the granitic rocks of the Meguma Zone, especially the South Mountain Batholith, has been defined by both field relationships and radiometric determinations. Early Devonian (Emsian) fossils occur in the rocks of the Torbrook Formation in an area intruded by granodiorite of the South Mountain Batholith (Taylor, 1969). Reynolds and Muecke (1978), using $^{40}Ar/^{39}Ar$, dated metasedimentary rocks of the Meguma Zone and suggested a minimum value of 400 to 415 Ma for the time of initiation of the Acadian Orogeny in Nova Scotia. Contact metamorphism associated with the intrusion of the granites overprints the regional metamorphic assemblages and marks the end of the Acadian event in Nova Scotia. Near Windsor, northwest of Halifax, the South Mountain Batholith is overlain nonconformably by sedimentary rocks of the Horton Group. Howie and Barss (1975) assigned the Horton Group of the Windsor area an Early Carboniferous (Tournaisian) age based on palynological data. These field relationships bracket intrusion of the bulk of the granitic rocks between Early Devonian (Emsian) and Early Carboniferous (Tournaisian) times.

In recent years the granitic rocks of the Meguma Zone have been dated radiometrically by a variety of methods and laboratories (Fairbairn et al., 1960, 1964; Cormier and Smith, 1973; Keppie and Smith, 1978; Clarke and Halliday, 1980; and Reynolds et al., 1981). The apparent ages range from about 250 to 420 Ma, but certain data clusters are consistent and significant. Clarke and Halliday (1980) using Rb/Sr isochrons of whole rock and mineral separates dated the main intrusive phases of the South Mountain Batholith as follows: biotite granodiorite (371.8 ± 2.2 Ma), adamellite (monzogranite in this paper 364.3 ± 1.3 Ma) and porphyry (361.2 ± 1.4 Ma). Their data are in agreement with both the observed field relations among the various intrusive phases of the Batholith as reported by McKenzie and Clarke (1975) and the paleontological and stratigraphic time bracket of the country rocks.

Reynolds et al. (1981), using K/Ar and $^{40}Ar/^{39}Ar$ data, concur with Clarke and Halliday (1980) and have defined a mean age of 367 Ma for the phases of the South Mountain Batholith and some satellite plutons to the north and east. They also recognized in their data a cluster of apparent ages in the range 300 to 320 Ma for satellite granitic plutons in the southern portion of the Meguma Zone. Similar young dates, although minor in number, were reported by Keppie and Smith (1978) in a compilation of radiometric age determinations of these same granitic rocks. The significance of these younger granites in Nova Scotia has only been considered seriously in recent years since the geological studies of potentially economic deposits of Sn, U and related elements indicated mineralizing episode(s) in southwestern Nova Scotia in the 270 to 340 Ma interval (Reynolds et al., 1981; Chatterjee, 1983).

NEW AGES

Many mineral occurrences known to be associated with the South Mountain Batholith have been studied by G. A. O'Reilly since 1979. Radiometric age determinations have been carried out as part of these studies on samples from the following three selected deposits: the Long Lake W, Mo, Cu, Ag prospect, the Westfield W, Mo, Sn, Ag, Au prospect and the Lake Darling Cu occurrence (Fig. 1). The geology of these deposits is described in detail by O'Reilly (1982), Chatterjee and Muecke (1982), O'Reilly et al. (1982) and O'Reilly (in preparation). A summary of the Rb/Sr analytical data is presented in Table 1, and Rb/Sr whole rock isochron plots for the Long Lake and Westfield prospects are given in Figure 2.

Table 1. Rb/Sr analytical data for whole rock isochron plots of granitic samples from the Long Lake and Westfield prospects and a mineral age determination of a muscovite separate from greisen from the Lake Darling Cu occurrence (locations on Fig. 1).

Sample No.	Rb(ppm)	Sr(ppm)	$^{87}Rb/^{86}Sr$	$^{87}Sr/^{86}Sr$	Age (Ma)
LONG LAKE PROSPECT					
A9B 7530	290.0	170.5	4.9326	0.73162 ± 7	
A9B 7539	430.0	97.8	12.7489	0.76810 ± 10	
A9B 7565	362.8	156.2	6.7418	0.74072 ± 6	332 ± 10
A9B 7570	295.0	177.6	4.8186	0.73105 ± 9	
A9B 7571	306.6	200.1	4.4424	0.72897 ± 6	
A9B 7572	271.1	194.3	4.0447	0.72763 ± 7	
WESTFIELD PROSPECT					
A7C 7506	198.3	73.1	7.8786	0.74673 ± 6	
A7C 7526	191.5	56.0	9.9393	0.75464 ± 8	
A7C 7529	213.4	100.4	6.1694	0.74064 ± 8	270 ± 14
A7C 7584	210.2	102.6	5.9458	0.73930 ± 6	
A7C 7587	195.6	88.9	6.3864	0.74079 ± 6	
LAKE DARLING OCCURRENCE					
A9C 7584	2,237.2	6.53	1619.8	7.1804 ± 1	281 ± 5

Long Lake Prospect

The Long Lake prospect consists of a greisenized granite developed for approximately 0.62 miles (1 km) along the contact of the South Mountain Batholith with Meguma Group hornfels (O'Reilly et al., 1982). The following three main granitic phases are exposed in the area: a biotite-muscovite monzogranite similar in texture and composition to the monzogranite of McKenzie and Clarke (1975), a greisenized granite-leucomonzogranite complex which hosts most of the mineralization, and a small plug of medium grained muscovite-biotite granite. The muscovite-biotite granite outcrops along the nearby Gold River where it intruded the monzogranite, but its relationship to the greisenized granitic complex is not exposed. Small greisen zones developed within the muscovite-biotite granite contain a similar mineral assemblage to that observed in the greisenized granite. This suggests the plug may have played a role in

formation of the greisenized granite complex. A suite of six samples of the muscovite-biotite granite yielded a Rb/Sr whole rock isochron age of 332 ± 10 Ma (Fig. 2).

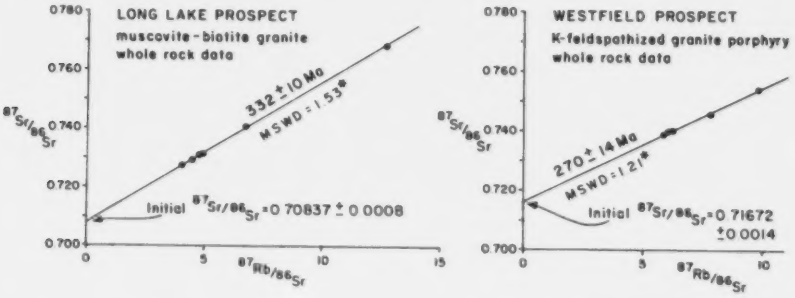

Figure 2. Rb/Sr whole rock isochron plots for the Long Lake and Westfield prospects (locations on Fig. 1). MSWD* (Mean Square of Weighted Deviates) is a numerical measure of goodness of fit of data points to a straight line (Brooks et al., 1972). This value is dependent on precise estimation of analytical error and the total number of points defining the isochron. A value of 2.5 or less is desirable because any value greater than this may incorporate reasons other than just experimental error for variation of the data from the straight line.

Westfield Prospect

The Westfield prospect in part consists of a porphyry-greisenized granite complex located at the contact of the granodiorite of the South Mountain Batholith with Meguma Group slate (O'Reilly, 1982, in preparation). The Westfield prospect is underlain by a grey-cream coloured K-feldspathized granite porphyry. The porphyry (approximately 0.77 square miles (2 km^2) in area) contains highly greisenized and albitized zones which commonly occur within 164 feet (50 m) of the contact with the Meguma Group slates. It is within these greisen zones and exocontact polymetallic quartz veins that most of the mineralization exists. Immediately to the north of the porphyry-greisenized granite complex a vast expanse of porphyritic biotite granodiorite is found. A suite of five samples of the porphyry collected from road outcrops yielded a Rb/Sr whole rock isochron age of 270 ± 14 Ma (Fig. 2).

Lake Darling Cu Occurrence

The Lake Darling Cu occurrence, located near the Village of New Ross (Fig. 1) consists of a small <4-8 inches (<10-20 cm) wide quartz pegmatite dyke which intruded porphyritic biotite-muscovite monzogranite. Associated with the pegmatite is a variably greisenized selvage 2-8 inches (5 to 20 cm) in width. (O'Reilly et al., 1982). Chalcopyrite

flecks are disseminated in micaceous portions of the quartz muscovite greisen. The greisen grades into the enclosing porphyritic monzogranite over an interval of about 6.5 feet (2 m). A Rb/Sr mineral age determination of a muscovite separate from the greisen yielded an age of 281 ± 5 Ma.

DISCUSSION

Recent geological studies have revealed the coincidence of Hercynian radiometric age determinations (260-340 Ma) of granitic rocks associated with significant Sn, W and U mineralizations in southwestern Nova Scotia (Reynolds et al., 1981; Chatterjee et al., 1982; Chatterjee, 1983). The geological setting and style of mineralization of the large East Kemptville tin deposit (Fig. 1) compares well with similar deposits in the Hercynian Erzgebirge tin district of Czechoslovakia (Richardson et al. 1982). The economic significance of these observations alludes to the importance of better definition of this Hercynian episode in Nova Scotia.

Chatterjee and Muecke (1982) defined the development of a para-intrusive suite of rocks within the cogenetic granitoid suite of the South Mountain Batholith. The paraintrusive suite consists of biotite leucogranite, argillized and sericitized granites, alibitzed granite, albitite and greisen, and is probably the product of interaction of a fluid phase with residual magma or the cogenetic crystalline rocks or both. It is with these para-intrusive rocks that the significant Sn-U mineralization in southwestern Nova Scotia is at least spatially associated. Radiometric age determinations of members of this para-intrusive suite commonly yield apparent ages in the Hercynian interval (260-340 Ma). These young dates are anomalous relative to the Middle Devonian dates (360-375 Ma) common to phases of the cogenetic suite which make up the bulk of the granitic rocks of the Meguma Zone. Whether this time discrepancy represents a long lasting late stage intrusive period in the differentiation of the cogenetic suite or an overprinting of the granitic rocks by a separate Late Permo-Carboniferous magmatic or thermotectonic event is at present unclear.

In Newfoundland, Bell and Blenkinsop (1977) recognized a Hercynian episode of intrusion and deformation. They cited the economic importance of the Hercynian magmatism in that area even though the mineralized granites volumetrically represent only a small portion of the total of the granitic rocks. Ruitenberg et al. (1977) related lower Middle Carboniferous tectonism, granitic plutonism and felsic volcanism with significant deposits of granophile elements in southern New Brunswick. Again, as in Newfoundland and Nova Scotia, this Middle Carboniferous magmatic activity in New Brunswick occurred in a region of extensive granitic plutonism of apparent Middle Devonian (Acadian) origin.

An age of 332 ± 10 Ma for the muscovite-biotite granite at Long Lake can conceivably be answered by a long lasting late stage intrusive period associated with the Middle Devonian cogenetic suite. It would seem unlikely though that a cogenetic suite such as the South Mountain Batholith whose latest stage differentiates crystallized around 360 Ma (Clarke and Halliday, 1980) could maintain a pneumatolytic-hydrothermal system to last in the order of the 50 to 80 Ma necessary to reset ages to the 270 to 300 Ma interval observed at Westfield and Lake Darling. Dates in this younger

interval, therefore, support the alternative of existence of a separate Late Carboniferous-Permian (Hercynian) magmatic or thermotectonic event.

To confirm a Carboniferous magmatic event in the Meguma Zone, obtaining dates from separate intrusive bodies hosted by the pre-existing Devonian granitic rocks or the Cambro-Ordovician metasedimentary rocks is required. The muscovite-biotite granite at Long Lake represents such a separate and younger intrusion. At Long Lake the muscovite biotite granite occurs as a separate plug which, based on field evidence, has intruded monzogranite of the South Mountain Batholith (O'Reilly et al., 1982). The porphyry at Westfield represents an alteration phase of the granodiorite of the South Mountain Batholith. The anomalously young age of the Westfield porphyry relative to the granitic phases of the South Mountain Batholith (270 vs 370 Ma) infers the porphyry is probably not related directly and genetically to the Middle Devonian plutonism. If the porphyry does not represent a separate intrusive phase then it must be related to updating by a post Acadian thermal event. Model Pb ages on galena of 310 Ma from the Long Lake prospect and 290 Ma from the Westfield prospect by Chatterjee (1983) corroborate the Rb/Sr isochron apparent ages indicating that ore deposition was during the same Hercynian interval as the magmatic or thermotectonic event.

The Lake Darling occurrence data must be interpreted with more care because the deposit is hosted by a monzogranitic phase from which a Rb/Sr mineral and whole rock isochron previously had indicated an age of 364.3 ± 1.3 Ma (Clarke and Halliday, 1980). The apparent age of 281 ± 5 Ma for a Rb/Sr determination on muscovite from greisen is in apparent contradiction to this isochron age. A Hercynian thermotectonic event or intrusion of younger granitic plutons into the older Middle Devonian granitic phases would result in introduction of heat and a fluid phase with potential to alter and reset ages in localized areas of the Batholith.

A similar situation to the Lake Darling occurrence has been described at the old Dunbrack Pb-Zn-Ag mine in the Musquodoboit Batholith west of Halifax (Reynolds et al., 1981; Fig. 1). They used $^{40}Ar/^{39}Ar$ data to obtain an apparent age of 304 Ma for sericitic alteration associated with the mineralization and the host monzogranite yielded a 362 Ma apparent age. MacMichael (1975) wrote that at the Dunbrack mine a fine grained granitic dyke appears to be associated with the mineralization, but this phase was not dated. Conceivably this fine grained granitic dyke could be related to the younger event which has caused updating of the monzogranite. The younger greisen ages such as the Lake Darling occurrence and the Dunbrack mine can be interpreted because of recognition of at least a Hercynian thermotectonic event in the Meguma Zone of Nova Scotia.

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CARBONIFEROUS BASIN STUDIES, SALT, POTASH, CELESTITE AND BARITE-NEW EXPLORATION POTENTIAL IN THE SYDNEY BASIN, CAPE BRETON ISLAND*

R. C. Boehner

New field activities were not undertaken in 1984, however, geological maps were completed for the Sydney Basin and Loch Lomond Basin-Glengarry Half Graben. The maps are expected to be available in 1985 as final, five colour, 1:50 000 scale sheets similar to those previously published for the Antigonish, Eureka and Shubenacadie Basins (Nova Scotia Department of Mines and Energy, Maps 82-2, -3 and -4).

The Sydney Basin Project (Canada-Nova Scotia Co-operative Mineral Program 1981-84) was initiated in 1982 and completed in 1984. The Basin has many similarities to the Loch Lomond Basin, especially in stratigraphy, geology and mineral deposits of the Windsor Group (Boehner, 1984). Diamond-drilling for stratigraphic information in poorly known units was a very important part of the Project (Fig. 1). The following six holes (Figs. 2, 3, 4 and 5) were completed: NSDME Sydney 82-1 at 3,323.5 feet (1013 m); NSDME Point Edward 83-1 at 2,497.7 feet (761.3 m); NSDME Woodbine Road 84-1 at 2,031.5 feet (619.2 m); NSDME Kempt Head 84-1 at 3,094.5 feet (943.2 m); NSDME Point Edward 84-1, at 1,471.5 feet (448.5 m); and NSDME Woodbine Road 84-2, at 502 feet (153 m) totalling approximately 12,920 feet (3940 m). This drilling has contributed significant new information to general geological interpretations. In addition to important contributions to the understanding of mineral deposits in the area, significant mineralization was intersected in two drillholes, NSDME Woodbine Road 84-1 (celestite) and NSDME Kempt Head 84-1 (halite, sylvite and carnallite).

CELESTITE AND BARITE

The presence of celestite has been known at Frenchvale and near Sydney River since the early 1970s when celestite exploration and development were active in the Loch Lomond area (Felderhoff, 1978). Celestite was never reported from the southern border of the Sydney Basin where NSDME Woodbine Road 84-1 was drilled (Fig. 1). The discovery of 2.3 feet (0.7 m) of 27% $SrSO_4$ at a depth of 1,168 feet (356 m) together with the stratigraphic and lithological similarities to Loch Lomond (Boehner, 1981, 1983, 1984) may indicate substantial new exploration potential for major stratabound celestite and possibly barite. The new geologically favourable area in the Sydney Basin is nearly as large as that at Loch Lomond, but has not been extensively explored.

SALT AND POTASH

The discovery of a thick section of saline evaporites in the lower part of the Windsor Group (Major Cycles 1 and 2) in NSDME Kempt Head 84-1 has allowed a more confident interpretation of the potash stratigraphy in the highly deformed Malagawatch and Orangedale prospects in central Cape

*Canada-Nova Scotia Co-operative Mineral Program 1981-84
Canada-Nova Scotia Mineral Development Agreement
Mainly funded by Province of Nova Scotia

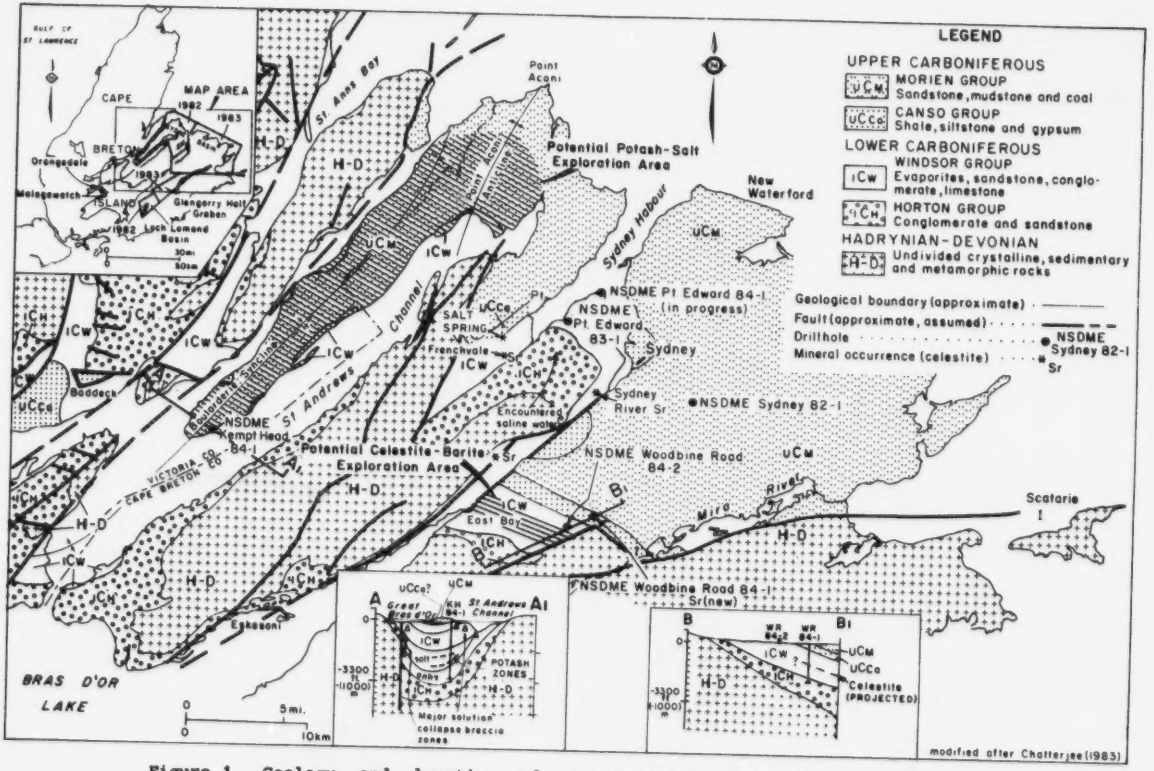


Figure 1. Geology and location of stratigraphic drillholes and new industrial mineral occurrences, Sydney Basin, Cape Breton Island.

Breton. Two potash zones were intersected in Kempt Head: 4.6 feet (1.4 m) of 3.9% K_2O (primarily carnallite) at 1,942 feet (592 m) (Chevron Middle Zone); and 16.4 feet (5.0 m) of 6.0% K_2O (sylvite and carnallite) at 2,441 feet (744.2 m) (Chevron Lower or Main Zone). The Windsor Group in the Boularderie Syncline is extensively collapse brecciated at the unconformity beneath the Morien Group (uppermost 600 feet (180 m)) as it is in the near surface in the Malagawatch and Orangedale areas. It appears, however, to be only weakly deformed in contrast to the severe deformation and complicated folding at Malagawatch and Orangedale (Dekker, 1982).

Exceptionally deep water (locally exceeding 900 feet (275 m)) (Figs. 6 and 7) was inferred by Manchester (1965), based upon seismic profiles, to have been produced by a combination of folding and block faulting of Carboniferous rocks. The discovery of saline evaporites in the lower part of the Windsor Group in the Boularderie area, may provide an alternate explanation. The linear deep water trough of St. Andrews Channel and depressions in the Great Bras d'Or southwest and west of Kempt Head generally coincide with the projected outcrop of the saline evaporites (Major Cycle 1) around the perimeter of the Boularderie Syncline (cross-section $A\text{-}A_1$, Figs. 1 and 6). The deep water features therefore may be attributed primarily to dissolution and solution collapse of evaporites. This inferred large scale solution trench-karst depression system may not necessarily be entirely related to block faulting. Pre-Morien Group folding and fracturing may have allowed ground water circulation to contact the saline Windsor Group evaporites initiating the formation of the St. Andrews Channel trough and Great Bras d'Or depressions. Full development of the depressions, however may not have been achieved until much later. The history of development of these features is not clear. Gently dipping unconsolidated sediment indicated in the bottom of the depressions by the seismic profiles (Manchester, 1965) may represent a thick section of Quaternary sediments. Unconsolidated Cretaceous sediments known to be associated with paleokarst features in the Windsor Group of Mainland Nova Scotia and Cape Breton Island could also be present in parts of the depressions. The extent of downdip dissolution and collapse brecciation of evaporites associated with the large karstic features may be an important factor in the preservation and exploitability of potash and salt resources in the Boularderie area as well as in other parts of Cape Breton Island.

The presence of saline evaporites at Kempt Head and minor halite on the southern side of the Sydney Basin, together with a salt spring at Leitches Creek and saline groundwater at Point Edward (NSDME Point Edward 83-1), may indicate more widespread distribution of saline evaporites in the Sydney Basin than previously believed.

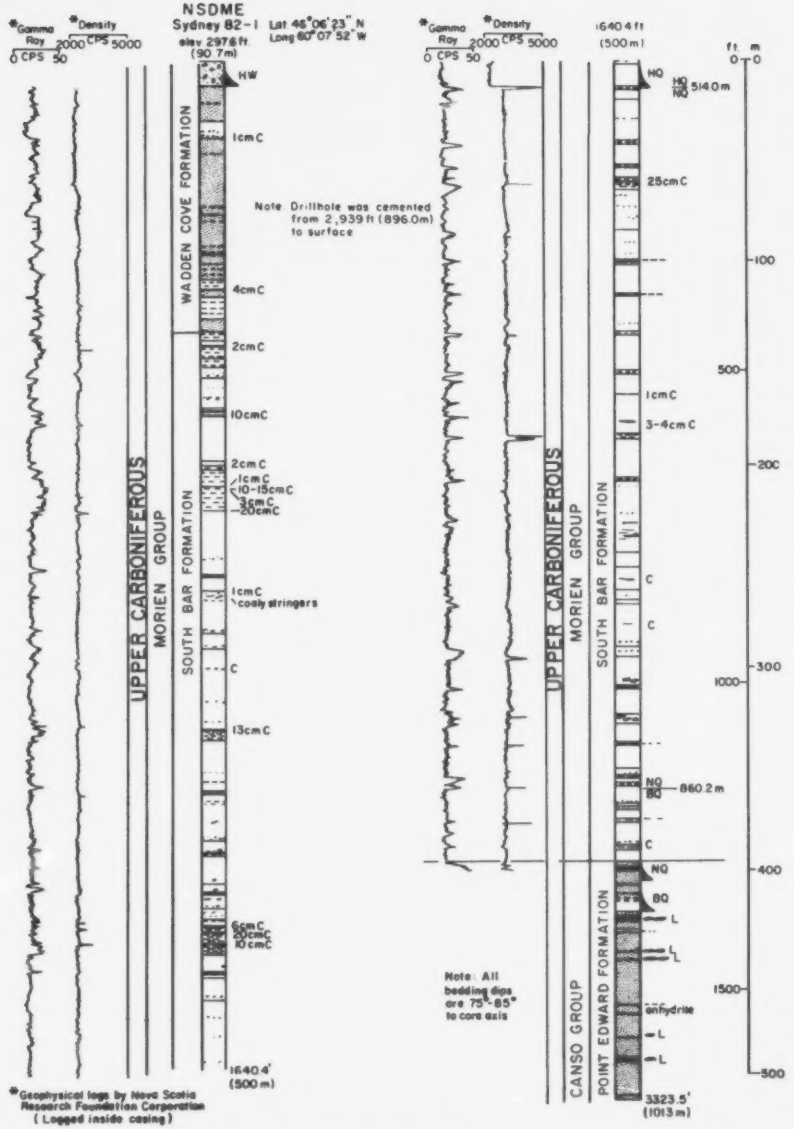


Figure 2. Drillhole profile NSDME Sydney 82-1, Sydney Basin, Cape Breton Island.

LEGEND

Overburden

Mudstone, shale (predominantly grey)

Sandstone, siltstone, mudstone (predominantly red; minor green-grey: g)

Sandstone, grey, grey brown, med-coarse grained, locally gritty

Conglomerate and sandstone, red locally with minor limestone nodules

Conglomerate, red

Limestone, dolostone, variably silty and fossiliferous

Anhydrite, gypsum

Halite (± anhydrite)
Halite (+ mudstone)

Potash (carnallite + halite ± minor sylvite)

Lost core or no core

Coal (thickness) ..... 10cm C
Limestone nodules, nodular limestone ..... L L
Mud and /or coal clasts .....
Breccia ..... Δ Δ Δ
Algal stromatolites .....
Tropari Test - Magnetic azimuth/ deviation from vertical (0°) Depth ..... 178°/3° 2700 ft (823.0m)
Shear, fracture, fault ..... ∿ ∿
Bedding dips measured with respect to the core axis ..... 75°
Core size reduction, casing ..... NQ BQ L
Core recovery (50%) 50%

Note: in N.S.D.M.E. Kempt Head 84-1 actual K_2O values are probably double the reported analysis due to extensive leaching of carnallite by the KCl - NaCl saturated drill water (not saturated for carnallite)

Figure 2. continued.

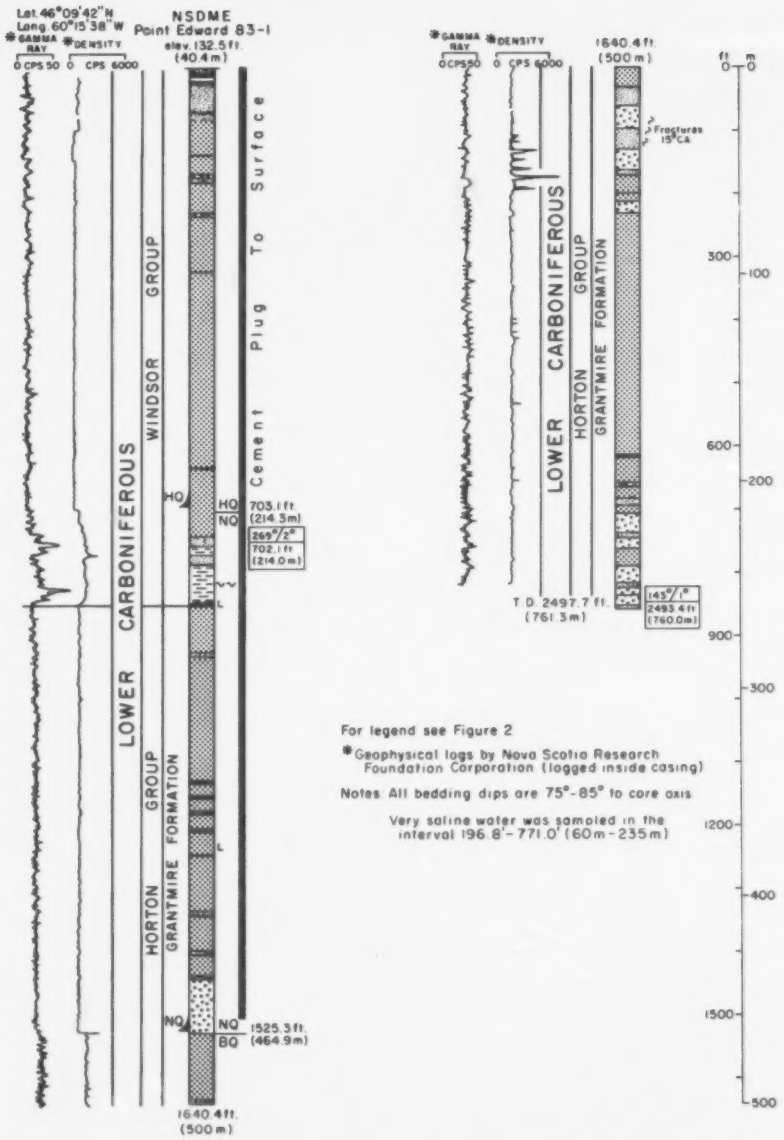


Figure 3. Drillhole profile NSDME Point Edward 83-1, Sydney Basin, Cape Breton Island.

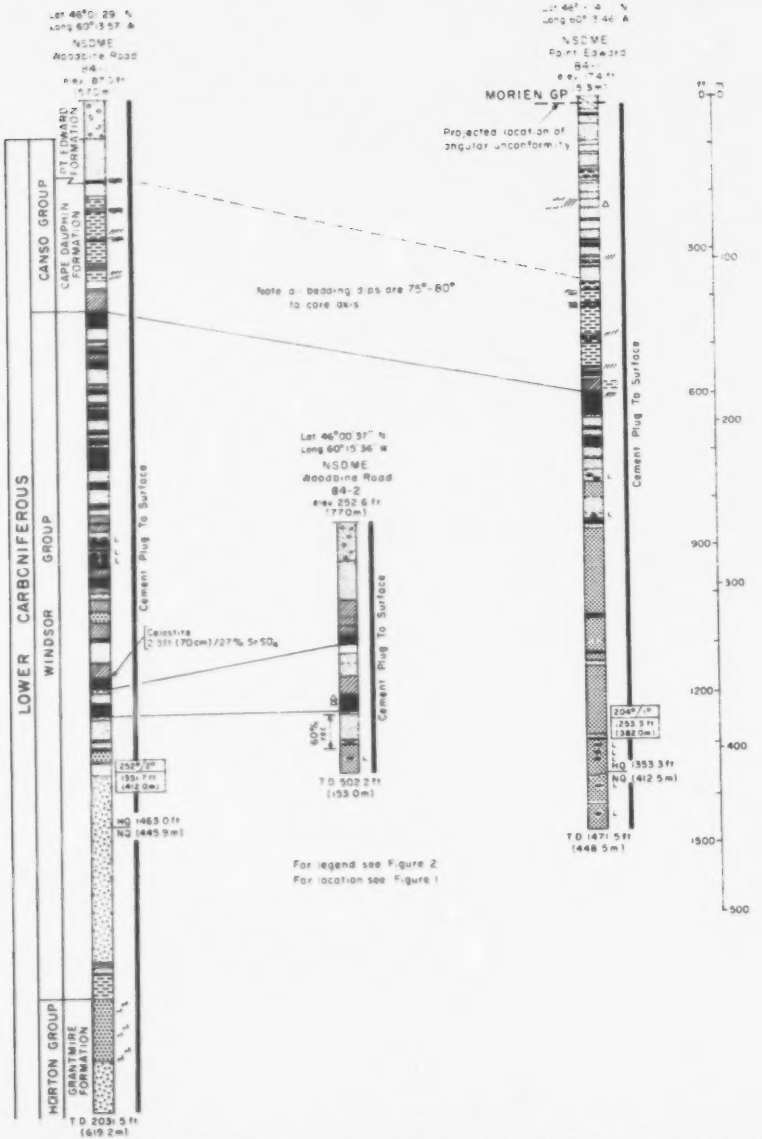


Figure 4. Drillhole profiles NSDME Woodbine 84-1, 84-2 and Point Edward 84-1, Sydney Basin, Cape Breton Island.

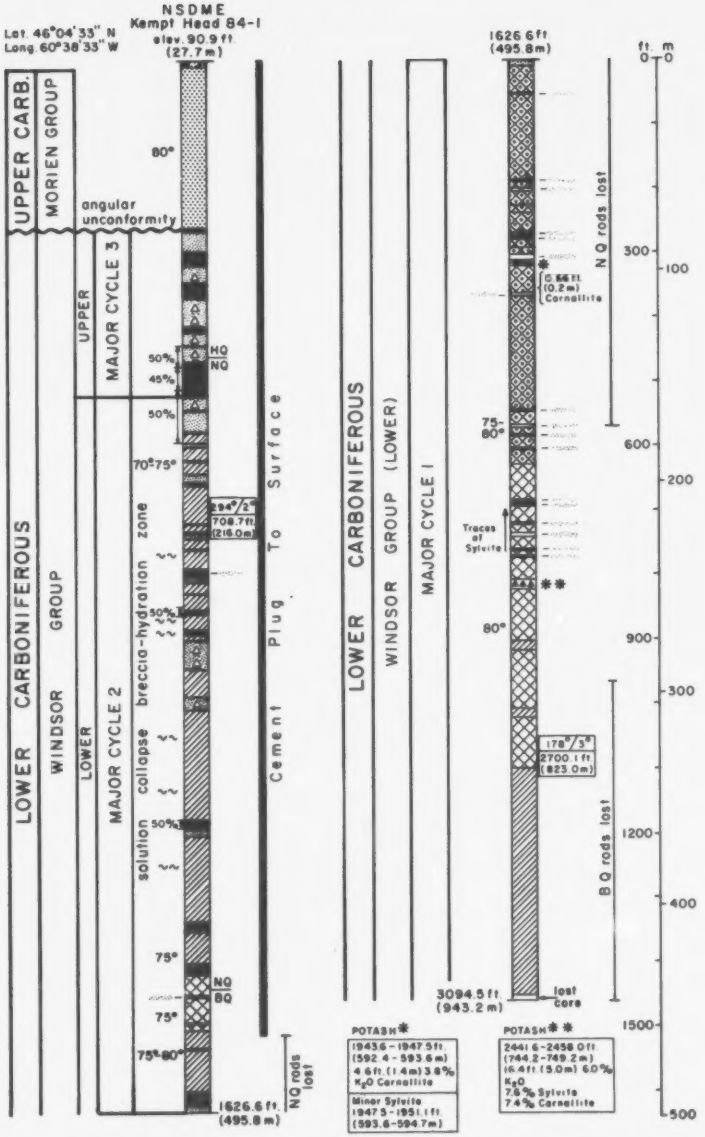


Figure 5. Drillhole profile NSDME Kempt Head 84-1, Sydney Basin, Cape Breton Island.

LEGEND

Overburden

Sandstone, siltstone, mudstone (predominantly red)

Sandstone, grey, grey brown

Limestone, dolostone, variably silty and fossiliferous

Anhydrite, gypsum

Halite (± anhydrite)
Halite (+ mudstone)

Potash (carnallite + halite ± minor sylvite)

Breccia ..... ΔΔΔ

Tropari Test – Magnetic azimuth/ deviation from vertical (0°) ..... 178°/5°
Depth ..... 2700 ft (823 m)

Shear, fracture, fault ..... ~~

Bedding dips measured with respect to the core axis ..... 75°

Core size reduction ..... NQ / BQ

Core recovery (50%) 50%

Actual K_2O values are probably double the reported analysis due to extensive leaching of carnallite by the KCl – NaCl saturated drill water (not saturated for carnallite)

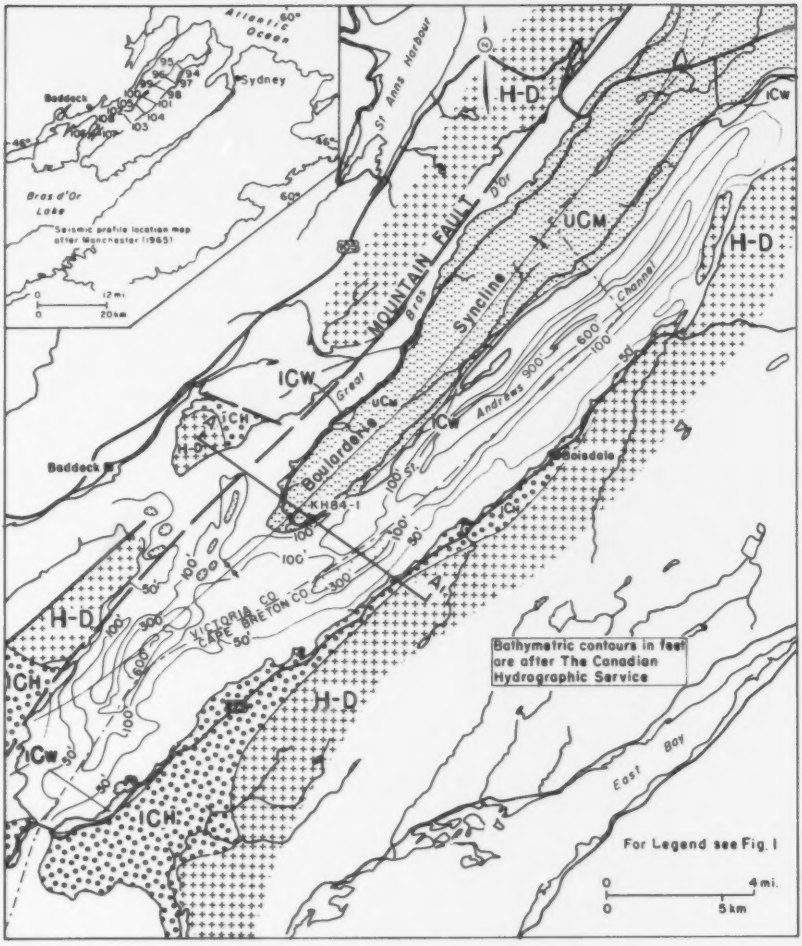
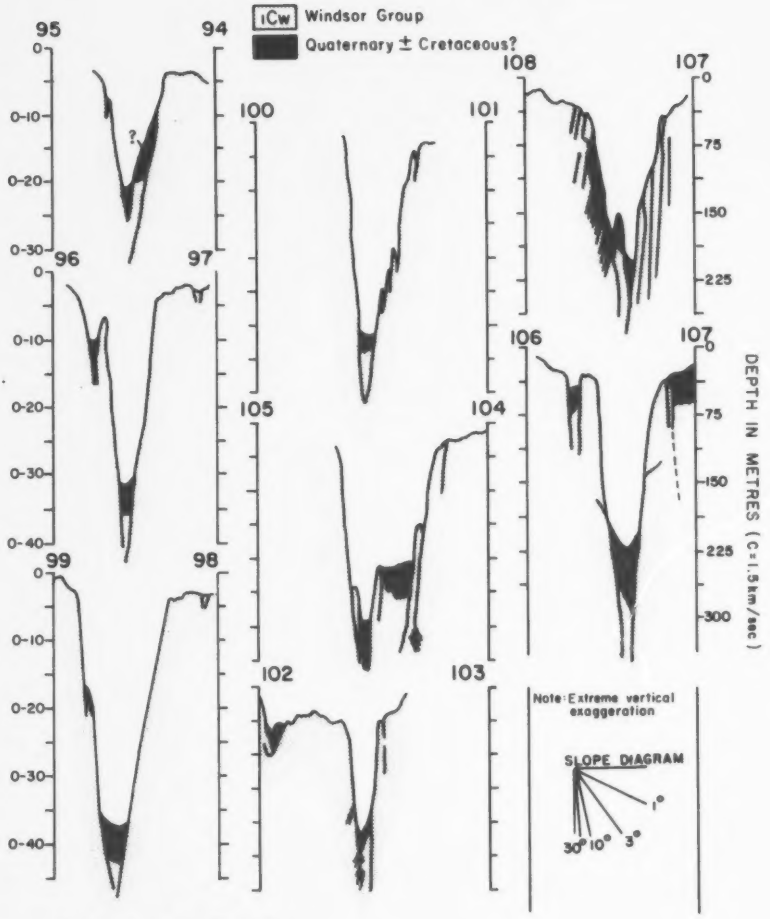


Figure 6. Bathymetry, geology and seismic profile location map, Boularderie Syncline area, Cape Breton Island.



For locations see Figure 6
Figure modified after Manchester (1965)

Figure 7. Seismic profiles St. Andrews Channel and Great Bras d'Or, Cape Breton Island.

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AVALONIAN VOLCANIC ROCKS OF NOVA SCOTIA*

J. Dostal**, J. D. Keppie and J. B. Murphy***

ABSTRACT

The nature of Late Precambrian volcanic rocks in the Avalon Composite Terrane in Nova Scotia varies from one terrane to another: (i) in the Cape Breton Terrane, calc-alkaline basalts, andesites, rhyolites and pyroclastics characteristic of a cratonic volcanic arc are prevalent (Fourchu and Keppoch Formations); (ii) in the Antigonish Terrane, tholeiitic basalts (Chisholm Brook Formation) and oceanic island alkali basalts (Clydesdale Formation) occur in an interarc basin; and (iii) in the Cobequid Terrane, pyroclastic rocks similar to those of the Cape Breton Terrane are present.

During transgression immediately following the accretion of these Terranes into the Avalon Composite Terrane, bimodal alkali and tholeiitic, within-plate Cambrian volcanism occurred in small pull-apart rifts. Volcanism next occurred at the beginning of the Silurian with the eruption of bimodal, within-plate continental tholeiitic lavas associated with the minor rifting event preceeding the Silurian transgression. Mid-Late Devonian and earliest Carboniferous volcanism in the Avalon Composite Terrane is typically bimodal, alkali and tholeiitic, within-plate and continental, and formed in reponse to rifting associated with the pull-apart Magdalen Basin produced during the Acadian Transpression Stage.

*Presented at 19th Annual Meeting, Northeastern Section, Geological Society of America, Providence, Rhode Island, March 15-17, 1984; *in* Abstracts with Programs, 1984; Geological Society of America, v. 16, no. 1, p. 12.

**Department of Geology, Saint Mary's University, Halifax, Nova Scotia

***Department of Geology, Saint Francis Xavier University, Antigonish, Nova Scotia

TECTONICS OF THE MEGUMA TERRANE, NOVA SCOTIA*

J. D. Keppie

ABSTRACT

The Meguma Terrane was accreted to the developing Appalachian orogen during the Devonian Acadian Orogeny. It consists largely of turbidites of the Cambian Goldenville Formation overlain by black shales of the Halifax Formation inferred to represent a submarine plateau environment. A regional unconformity associated with local deformation in the Yarmouth area separates the Siluro-Devonian rocks from the Cambro-Early Ordovician Meguma Group. The Siluro-Devonian stratigraphic record typically begins with bimodal, within-plate, cratonic, rift volcanism followed by shallow water shelf to basinal sediments and ending with continental redbeds. This was terminated by the early phase of the Acadian Orogeny due to accretion of the Meguma Terrane. This produced the upright regional folds, pressure solution and slaty cleavages and later, local, recumbent crenulations. There followed static Pyrenean metamorphism and associated granitic plutonism followed immediately by the development of ductile deformation zones by dextral shear along the Minas Geofracture during the last Devonian-earliest Carboniferous phase of the Acadian Orogeny. Terrestrial (and minor marine) sedimentation during the Mid-Devonian to Permian took place in the Magdalen pull-apart basin and in the Hercynian foreland basin. Two phases of the Hercynian Orogeny occurred during the Westphalian and Mid-Late Permian. Finally, rifting associated with the birth of the Atlantic Ocean produced the early Mesozoic redbeds and tholeiitic plateau basalts.

*Presented at 19th Annual Meeting, Northeastern Section, Geological Society of America, Providence, Rhode Island, March 15-17, 1984; *in* Abstracts with Programs, 1984; Geological Society of America, v. 16, no. 1, p. 28

GEOCHRONOLOGICAL CONSTRAINTS ON THE ACCRETION OF THE MEGUMA TERRANE WITH NORTH AMERICA*

R. D. Dallmeyer** and J. D. Keppie

ABSTRACT

The Cambro-Ordovician Meguma Group of eastern Nova Scotia records a complex tectonothermal history including: (i) early polyphase deformation accompanied by greenschist facies metamorphism; (ii) static Pyrenean metamorphism and associated granitoid plutonism; (iii) formation of regionally inhomogeneous ductile deformation zones spatially associated with the Minas Geofracture; and (iv) local brittle deformation. The time of deformation is constrained by the Early Devonian age of the youngest deformed rocks and the Tournaisian age of the Horton Group containing deformed Meguma clasts.

Undeformed static, decussate biotite from the Meguma Group in this area record $^{40}Ar/^{39}Ar$ plateau ages between 362 and 365 ± 7 Ma. Biotite and muscovite from undeformed granites record similar dates which are identical with Rb/Sr whole rock age. Dynamically recrystallized biotite and muscovite from ductile deformation zones developed within both the Meguma Group and the granitic plutons also yield well defined plateau ages between 365 and 373 ± 7 Ma. These results indicate that the ductile deformation zones developed immediately after granite emplacement and prior to regional cooling below argon retention temperatures. These data suggest that accretion of the Meguma and Avalon composite Terranes took place during the Devonian. Possible Hercynian activity along the Minas Geofracture is therefore limited to brittle deformation.

*Presented at 19th Annual Meeting, Northeastern Section, Geological Society of America, Providence, Rhode Island, March 15-17, 1984; *in* Abstracts with Programs, 1984; Geological Society of America, v. 16, p. 11.

**Department of Geology, University of Georgia, Athens, Georgia

U-Pb ZIRCON GEOCHRONOLOGY IN THE EASTERN MEGUMA TERRANE OF NOVA SCOTIA*

T. E. Krogh** and J. D. Keppie

ABSTRACT

The Cambro-Ordovician Meguma Group suffered the following effects of the Acadian Orogeny: (i) early polyphase deformation during greenschist facies metamorphism; (ii) static Pyrenean metamorphism and associated granitoid plutonism; and (iii) late, dextral shear deformation associated with ductile deformation zones during greenschist facies metamorphism. Two samples of chlorite grade wackes from upper and lower parts of the Goldenville Formation each yielded several distinct populations of zircons. U-Pb data for these zircon populations will be presented and should provide some constraints on the age of the source for the Goldenville turbidites. Four granitoid plutons were sampled for zircons: Sangster Lake, Larrys River, Halfway Cove and Queensport. Zircons from these plutons are expected to be complex. U-Pb data on these zircons will be presented and should provide the ages of intrusion, constraints on the time of deformation and metamorphism, and possibly the age of the source of the granites.

*Presented at 19th Annual Meeting, Northeastern Section, Geological Society of America, Providence, Rhode Island, March 15-17, 1984; *in* Abstracts with Programs, 1984; Geological Society of America, v. 16, p. 28

**Department of Mineralogy and Geology, Royal Ontario Museum, Toronto, Ontario

SILURO-DEVONIAN DEFORMATION IN THE CALEDONIDE OROGEN*

J. D. Keppie, D. G. Gee** and E. Martinez-Garcia***

ABSTRACT

Siluro-Devonian deformation is widespread throughout the Caledonide Orogen. It is represented by the Scandian Orogeny in Scandanavia, Spitzbergen and Greenland, the main Caledonian events in Britain, the Ligerian Orogeny in western Europe, and the Acadian Orogeny in the Appalachians. It appears to be absent in Morocco and the Mauritanides. In many areas, the deformation was intense and involved major overthrusting and recumbent folding, followed by steep refolding towards the axes of the belts. Emplacement of these nappes took place over 20 to 40 Ma and produced foreland basin clastic wedges and peripheral bulge erosional unconformities. The onset of deformation becomes progressively older towards the axes of the belts where it is at least as old as early Wenlock at the continental margins, but may be as old as Late Ordovician in the ocean basins. The Devonian is characterized by several pulses of deformation which become more frequent in the Carboniferous heralding the terminal collisional event in the Permian. These deformational events may be related to both continuous subduction in Iapetus and the closure of several small ocean basins. The orientation of these basins relative to plate motions explains the extent of obduction versus transpression.

*Presented at International Geological Correlation Program, Caledonide Orogen Project Symposium, Glasgow, Scotland, September 1984

**Swedish Geological Survey, Uppsala, Sweden

***Depto de Geotectonica Facultad de Geologia, Uviversidad de Oviedo, Oviedo, Spain

THE NATURE AND ROLE OF BASEMENT ROCKS IN THE CALEDONIDE OROGEN*

Derek Powell[1], T. B. Anderson[2], A. A. Drake, Jr.[3], Leo Hall[4] and J. D. Keppie

SUMMARY

Available isotopic data suggest that the Precambrian basement elements of the northern part of the Caledonide Orogen in North America, Britain, Ireland, Greenland and Scandinavia, comprise largely Grenvillian and Svecofennian continental crust. There is only scant evidence for preservation of Archaean material. Early Caledonian (Grampian-Finnmarkian) orogenic activity gave rise, in the Scandinavian and British-Irish sectors, to an early Palaeozoic basement which, in Norway, is overlain by Lower Palaeozoic supra-crustal sequences. In contrast, a late Precambrian-early Cambrian (Cadomian-Avalonian and older) basement is present in southern parts of the Orogen.

Though more isotopic data are needed, location of boundaries between Precambrian age provinces, both within and adjacent to the Caledonides, provides constraints on models for the plate tectonic setting of the Orogen.

*Presented at International Geological Correlation Program, Caledonide Orogen Project Symposium, Glasgow, Scotland, September 1984

[1]Department of Geology, Royal Holloway and Bedford Colleges, University of London, Egham, Surrey, United Kingdom

[2]Universitetet i Bergen, Geologisk Institutt Avd. A, 5000 Bergen, Norway

[3]United States Geological Survey, Reston, Virginia 22092

[4]Department of Geology, University of Massachusetts, Amherst, Massachusetts 01003

PALEOCONTINENTAL RECONSTRUCTIONS FOR THE LATE CALEDONIAN AND HERCYNIAN OROGENIES*

D. V. Kent** and J. D. Keppie

ABSTRACT

The Late Caledonian and Hercynian Orogenies may be interpreted as the multistage interaction between Laurentia, Baltica and Greater Gondwana (including Armorica and Avalonia). The Late Caledonian-Scandian-Early Acadian Orogeny is due to the closure of Iapetus. This phase was followed in mid-Devonian times by a sinistral megashear along the orogen, which eliminated latitudinal discrepancies between the three cratonic blocks and juxtaposed Greater Gondwana and Baltica. The final phase involved a rotation of Greater Gondwana towards Laurentia, expressed as late Acadian/early Hercynian dextral shear in Armorica and culminating in the Late Carboniferous/Permian Alleghanian Orogeny in the southern Appalachians.

*Presented at International Geological Correlation Program, Caledonide Orogen Project Symposium, Glasgow, Scotland, September 1984
**Lamont-Doherty Geological Observatory, Palisades, New York 10964

EDUCATION AND PUBLIC AWARENESS*

H. V. Donohoe, Jr.

The Education and Public Awareness Program of the Mines and Minerals Branch is concerned with the development of materials describing the geology and mineral resources of the Province. The Program is developing pamphlets and brochures on such topics as the geology of selected parks and areas in the Province, the history of gold mining in Nova Scotia and the geological development of Nova Scotia. A somewhat longer publication, *Mining History of Nova Scotia* , is in the advanced manuscript stage. Individual sections of this booklet will be the focus of shorter pamphlets describing the history of mining for a particular commodity or region.

Over the summer, displays and booths were prepared for the Nova Scotia Forestry Exhibition at Windsor, Hants County and for the Caledonia Gold Rush Days at Caledonia, Queens County. The Forestry Exhibition display developed the theme "Sharing the Forest - Exploration". Using photographs and captions the difference between exploration and mining and the various stages of exploration were described. At the Caledonia display the historical aspects of gold exploration and mining in the Queens County region were shown along with general information about the gold mining history of the Province.

The prospecting course continues to be very popular. During the spring of 1984 twenty-eight people took the course at Dalhousie University sponsored by the Department, the Chamber of Mineral Resources of Nova Scotia and the Department of Geology at Dalhousie. This fall, the same number of people have enrolled in the course in Truro. The Department and the Chamber are again sponsoring the course in conjunction with the Colchester-East Hants School Board. The Department is now researching the possibility of an advanced prospecting course.

The signing of the Canada-Nova Scotia Mineral Development Agreement (CNSMDA) has added a new dimension to the Education and Public Awareness Program. Funds are provided to prepare publications, audio-visual materials and displays which describe the geology and mineral resources of the Province and highlight the CNSMDA programs and their importance and results.

*Canada-Nova Scotia Co-operative Mineral Program 1981-84
Canada-Nova Scotia Mineral Development Agreement
Mainly funded by Province of Nova Scotia

INTERACTIVE GEOLOGICAL COMPUTING IN NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY*

D. Rigby

INTRODUCTION

The development of an interactive geological computing environment (IGE) within the Geochemical Section of the Department of Mines and Energy began in the summer of 1983. It was the unique creation of Kevin Marinelli, then a Masters graduate in computer science at Dalhousie University. The purpose of the IGE is to put scientific computer programs and the facilities of the Dalhousie University's CYBER computer at the service of Nova Scotia Department of Mines and Energy geologists. The objective is to provide on line instruction and interactive programs which require little or no programming knowledge (Fig. 1).

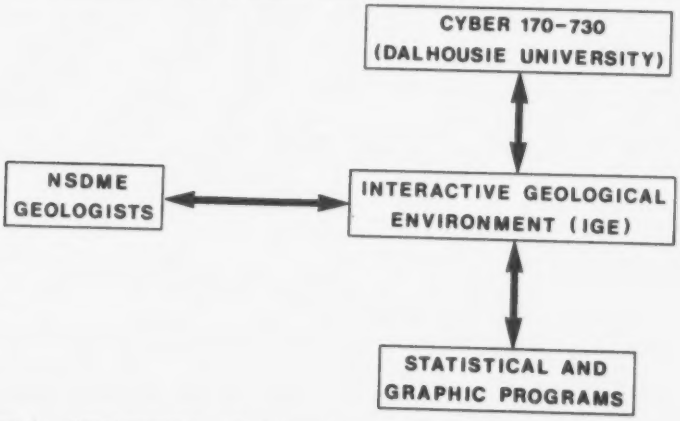

Figure 1. Configuration of interactive geological computing environment (IGE).

SYSTEM SUPPORT BY USER LIBRARIES

At the heart of the IGE are two user libraries ULIB/ULIB2 which contain subroutines, command files and executable programs. These libraries are automatically loaded in the CYBER account of the participating geologist at the time of logging in on an in-house terminal linked to the CYBER by a dial up modem. Data required as input into these programs can be stored in file formats of the geologist's choosing. All that is required is to describe the data in a file by means of a data description file.

*Canada-Nova Scotia Co-operative Mineral Program 1981-84
Canada-Nova Scotia Mineral Development Agreement
Mainly funded by Province of Nova Scotia

Information about what programs are available, what they do, require and produce is "on line" through an INFO file. This utility also includes information about the user libraries, how to create a data description file and how to transfer files between a backup tape and the disk. At the system level, a suite of procedures were developed to facilitate updating the libraries, menus and the INFO file. The side benefit of this concept is not only efficiency of execution, but low cost. Users need only keep data in their accounts. A single special account maintains all the user libraries and INFO files at a cost of about $50.00 a month.

WORKSTATIONS AND ACCESS TO DALHOUSIE CYBER

Initially the hardware configuration within the Geochemical Section was limited to a single workstation which consisted of a VUCOM 404 terminal, a 132 character Decwriter printer, and a 1200 baud direct connect modem. Through this connection, geologists were able to access the facilities on the Dalhousie CYBER. This included 2 CPUs with 196,000 words of central memory, 4800 megabytes of disk storage, 5 nine track tape drives at 800/1600 bpi. The operating system available is Nos 2.2 level 602. Both an 11 inch 1 pen Zeta plotter and a 34 inch 4 pen Zeta plotter are available as well as 60 public terminals. Batch, remote batch and interactive computing are supported. Among other languages the CYBER supports Fortran IV and V, the principal languages of scientific computing for many years.

During 1984, another two workstations were added. One is similar to the first workstation described above. It has enabled more geologists to use the IGE. The second workstation consists of an Osborne 1 micro computer with an 80 column card upgrade, a 12 inch Zenith monochrome monitor, a Switch-Com 1200 baud auto dial modem, and a 132 character Xerox daisy wheel printer. The software included, such a WORDSTAR, MICROLINK and DBASE2, has enabled some experimentation in the automated office concept. Memos and reports entered with the easy-to-use text formatting facilities of WORDSTAR can now be transferred to the Department's MICOM word processor via the CYBER at Dalhousie.

RECENT SOFTWARE DEVELOPMENT

Twenty of the most widely used programs developed or modified in the past year are listed in Tables 1 and 2. Most of them are interactive, that is, the program is designed to prompt the user from the screen for the inputs necessary to execute the program. The other programs require editing a file or preparing a control file before execution. Information about the program is available as an option during execution or may be read on line using the INFO command in IGE.

Only the most frequently used programs are maintained on line in one of the user libraries ULIB/ULIB2. The others are stored on a special backup tape until needed.

Table 1. New and modified programs, 1984.

NAME	DESCRIPTION
HISTB	PLOTS LOG NORMAL HISTOGRAM & CORRESPONDING PROBABILITY CURVE
SSORT	FILE SORTING BY MULTIPLE FIELDS; UP TO 12-80 COL CARDS/CASE
SORTGO	FILE SORTING BY MULTIPLE FIELDS; UP TO 2-132 COL CARDS/CASE
TRIPRT	TERNARY PLOT AT LOCAL PRINTER
TRIPLOT	TERNARY PLOT AT DALHOUSIE
ITGRDB	THREE DIMENSIONAL PLOTTING
RNORM	CALCULATES NORMATIVE COMPOSITION OF ROCKS; BARAGAR/IRVINE METHOD
WNORM	CALCULATES ANHYDROUS OR HYDROUS NORMATIVE COMPOSITION OF ROCKS
HISFREQ	PLOTS HISTOGRAM & CUMULATIVE FREQUENCY AT LOCAL PRINTER
MANVAR	DATA MANIPULATION AND LISTING
CGO3	PLOTS ANALYSIS OF VARIANCE OF PAIRED GSC FIELD CARD DATA
SCATT2	PLOTS A SCATTERGRAM
TAILAN	TAILS ANALYSIS; STATISTICS ON ANOMALOUS CONCENTRATIONS OF GEOCHEM DATA
URPSTAT	CALCULATES UNIVARIATE STATISTICS & HISTOGRAM FOR GSC FIELD CARD DATA
BAKLOAD	LOADS FILES FROM LIBRARY TAPE BACK ON A DISK ACCOUNT
BAKDUMP	DUMPS FILES FROM A DISK ACCOUNT TO A BACKUP LIBRARY TAPE
TARSEL	CALCULATES DRAINAGE AREAS ABOVE ANOMALOUS SITE
MONITOR	UPDATES GEOCHEM SECTION EXPENDITURES IN PROV/FED AGREEMENT
COMER	COMPARE AND MERGE FILES
LIBDEL	DELETES USER LIBRARY FILES

Table 2. Characteristics of new or modified 1984 programs

PROGRAM	CLASS*	INTERACTIVE	ONLINE	DATE	DEVELOPED/MODIFIED
HISTB	4	YES	NO	10/84	M
SSORT	5	YES	YES	10/84	M
SORTGO	5	YES	NO	10/84	D
TRIPRT	4	YES	YES	09/84	D
TRIPLOT	4	YES	YES	09/84	D
ITGRDB	4	YES	NO	09/84	D
RNORM	3	YES	YES	09/84	D
WNORM	3	YES	YES	08/84	D
HISFREQ	4/3	YES	YES	07/84	D
MANVAR	1/2	YES	YES	05/84	D
CGO3	3/4	NO	NO	07/84	D
SCATT2	4	YES	YES	04/84	D
TAILAN	3	YES	NO	04/84	D
URPSTAT	3/4	YES	NO	08/84	D
BAKLOAD	5	NO	NO	06/84	D
BAKDUMP	5	NO	NO	06/84	D
TARSEL	3	YES	NO	04/84	D
MONITOR	5	YES	NO	07/84	D
COMER	5	NO	NO	07/84	D
LIBDEL	6	NO	NO	09/84	D

CLASS CATEGORIES:

1. REFORMAT DATA
2. REPORT FORMATTING
3. STATISTICAL ANALYSIS
4. GRAPHIC ANALYSIS/DISPLAY
5. USER MAINTENANCE
6. SYSTEM MAINTENANCE

The programs can be classified into six general categories. Some programs such as MANVAR are designed to assist in reformatting data, or producing data listings for reports. Others focus on the maintenance of user or system files. The programs BAKDUMP and BAKLOAD, for example, facilitate transferring files between a backup tape and the user's disk account. The majority of the programs, however are directed to the main task of generating statistical and graphic analyses, and display of geological data.

The programs for development and modification are selected by individual geologists or groups of geologists working on similar types of analyses. Overall direction to the IGE is provided by a users committee.

The development of the IGE has been achieved by the dedicated and energetic work of programmers and students employed on winter works projects, student employment schemes and casual contracts. Planning within the Canada-Nova Scotia Mineral Development Agreement 1984 to 1989 has identified the need for an in depth study of the computing requirements for the Department. It has also resulted in the provision of a full time programmer/analyst to maintain and develop the IGE.

APPENDIX I

OPEN ASSESSMENT REPORTS FOR 1984

OPEN ASSESSMENT REPORTS FOR 1984

11D/11C 21-H-09(01)

GOLD, COW BAY, HALIFAX COUNTY, NOVA SCOTIA. R. PETERS. REPORT ON GROUND MAGNETIC SURVEY, BY R. PETERS, 1982. 3 PAGES; 2 MAP(S) (MAGNETIC, GROUND)

11D/11C 21-H-09(02)

GOLD, COW BAY, HALIFAX COUNTY, NOVA SCOTIA. D. PLASSE AND R. PETERS. REPORT ON GROUND MAGNETIC SURVEY, BY D. PLASSE, 1982. 9 PAGES; 3 MAP(S) (MAGNETIC, GROUND; MINE SURFACE PLANS); MAGNETIC PROFILES

11D/12C 51-H-95(01)

TIN, TANTALLON, HALIFAX COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED. REPORT ON GEOLOGICAL, TILL AND STREAM SEDIMENT GEOCHEMICAL SURVEYS AND THIN SECTION MICROSCOPY, BY J. L. MACLEOD, J. A. MCDONALD, 1982. 52 PAGES; 12 MAP(S) (GEOLOGICAL; METALLIC MINERAL LOCATION; PROPERTY LOCATION; STREAM SEDIMENT GEOCHEMICAL; TILL GEOCHEMICAL)

11D/13B 21-I-47(02)

GOLD, SOUTH UNIACKE, HANTS COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR R. MARCHANT). REPORT ON GEOLOGY, STREAM SEDIMENT GEOCHEMICAL, AIRBORNE VLF AND AIRBORNE MAGNETIC SURVEYS, BY C. MILLER, 1982. 11 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11D/13C 21-I-27(07)

GOLD, MOUNT UNIACKE, HANTS COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR R. MARCHANT). REPORT ON GEOLOGY, STREAM SEDIMENT GEOCHEMICAL, BIOGEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 12 PAGES; 6 MAP(S) (BIOGEOCHEMICAL; MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11D/13D 21-H-53(14)

GOLD, OLDHAM, HALIFAX COUNTY, NOVA SCOTIA. J. E. DAWE AND SEABRIGHT RESOURCES INCORPORATED (FOR S. HAVILL). REPORT ON ECONOMIC ASSESSMENT OF TAILINGS DEPOSITS, BY J. E. DAWE, 1982. 5 PAGES; 7 MAP(S) (PROPERTY LOCATION; TAILINGS GEOCHEMICAL; TAILINGS LOCATION)

11D/13D 21-H-53(15)

GOLD, OLDHAM, HALIFAX COUNTY, NOVA SCOTIA. LETTER TO E. R. FARIBAULT REGARDING THE SINKING OF A VERTICAL SHAFT IN THE OLDHAM GOLD DISTRICT, BY J. E. HARDMAN, 1903. 4 PAGES

11D/13D 21-H-53(16)

GOLD, OLDHAM, HALIFAX COUNTY, NOVA SCOTIA. AVON GOLD MINES LIMITED. REPORT ON GEOLOGY, MINING HISTORY AND PRODUCTION, BY C. SPEARMAN, 1935. 6 PAGES; BLOCK DIAGRAMS

11D/13D 21-H-53(17)

GOLD, OLDHAM, HALIFAX COUNTY, NOVA SCOTIA. AVON GOLD MINES LIMITED. REPORT ON SURFACE EXAMINATION AND PRODUCTION, BY C. PRICE-GREEN, 1935. 3 PAGES

11D/13D 21-H-53(18)

GOLD, OLDHAM, HALIFAX COUNTY, NOVA SCOTIA. AVON GOLD MINES LIMITED. REPORT ON THE FISH VEIN, AND THE OCCURRENCE OF ARSENOPYRITE ASSOCIATED WITH GOLD MINERALIZATION, BY C. SPEARMAN, 1938. 2 PAGES

11D/13D 21-H-53(19)

GOLD, OLDHAM, HALIFAX COUNTY, NOVA SCOTIA. AVON GOLD MINES LIMITED. REPORT ON MINING OPERATIONS AND PROPOSED DEVELOPMENT, BY C. SPEARMAN, 1938. 6 PAGES

11D/13D 21-H-53(20)

GOLD, OLDHAM, HALIFAX COUNTY, NOVA SCOTIA. CORRESPONDENCE REGARDING THE EVALUATION OF THE OLDHAM GOLD DISTRICT, BY J. E. GILL, G. R. PIETCH, 1935. 11 PAGES

11D/13D 21-H-53(21)

GOLD, OLDHAM, HALIFAX COUNTY, NOVA SCOTIA. AVON GOLD MINES LIMITED. REPORT ON GEOLOGY, VEIN STRUCTURE AND PROPOSED DEVELOPMENT, BY E. R. FARIBAULT, 1938. 7 PAGES

11D/14A 07-H-51(03)

BASE METALS, MUSQUODOBOIT HARBOUR, HALIFAX COUNTY, NOVA SCOTIA. NORANDA EXPLORATION COMPANY LIMITED. REPORT ON DRILLING, BY G. GRAVES, 1982. 17 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; IP LINES LOCATION; PROPERTY LOCATION; SOIL GEOCHEMICAL); CROSS SECTIONS; DRILL HOLE LOGS; MAGNETIC PROFILES; PSEUDO SECTIONS; VLF PROFILES

11D/14A 51-H-51(01)

TIN, MUSQUODOBOIT HARBOUR, HALIFAX COUNTY, NOVA SCOTIA. AQUITAINE COMPANY OF CANADA LIMITED (FOR AQUITAINE COMPANY OF CANADA LIMITED AND DOME PETROLEUM LIMITED). REPORT ON GEOLOGICAL, SOIL AND TILL GEOCHEMICAL SURVEYS AND AIRBORNE AND GROUND RADIOMETRIC SURVEYS, BY P. HAYWARD, L. HAM, 1981. 93 PAGES; 10 MAP(S) (GEOLOGICAL; RADIOMETRIC LINES LOCATION; RADIOMETRIC, AIRBORNE; TILL GEOCHEMICAL); HISTOGRAMS

11D/14D 21-H-93(01)

GOLD, MOUNT TOM, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON GEOLOGY, AND STREAM SEDIMENT GEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 16 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11D/15A 21-H-67(20)

GOLD, TANGIER, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON GEOLOGY, AND STREAM SEDIMENT GEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 16 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11D/15A 21-H-67(21)

GOLD, TANGIER, HALIFAX COUNTY, NOVA SCOTIA. NORANDA EXPLORATION COMPANY LIMITED AND M. MILNER (FOR NORANDA EXPLORATION COMPANY LIMITED). REPORT ON GEOLOGICAL AND TILL GEOCHEMICAL SURVEYS AND RECOMMENDATIONS FOR EXPLORATION OF PLACER GOLD DEPOSITS, BY P. M. DIMMELL, 1983. 9 PAGES; 3 MAP(S) (GEOLOGICAL; PROPERTY LOCATION; TILL GEOCHEMICAL)

11D/15A 21-H-86(01)

GOLD, SPRY BAY, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON GEOLOGY, AND STREAM SEDIMENT GEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 17 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11D/15A 51-H-99(01)

TIN, EAST LAKE, HALIFAX COUNTY, NOVA SCOTIA. QUINAN EXPLORATIONS. REPORT ON GEOLOGICAL SURVEY, BY E. DOUCETTE, W. DOUCETTE, G. FROTTEN, G. HARRIS, 1983. 8 PAGES; 3 MAP(S) (PROPERTY LOCATION; ROCK SAMPLE LOCATION)

11D/15B 07-H-97(01)

BASE METALS, SHIP HARBOUR, HALIFAX COUNTY, NOVA SCOTIA. NORANDA EXPLORATION COMPANY LIMITED. REPORT ON GEOLOGICAL AND TILL GEOCHEMICAL SURVEYS, BY P. M. DIMMELL, 1983. 8 PAGES; 9 MAP(S) (GEOLOGICAL; PROPERTY LOCATION; TILL GEOCHEMICAL)

11D/15B 53-H-29(01)

TUNGSTEN, LAKE CHARLOTTE, HALIFAX COUNTY, NOVA SCOTIA. NORANDA EXPLORATION COMPANY LIMITED. REPORT ON TILL HEAVY MINERALS, SOIL AND ROCK GEOCHEMICAL SURVEYS, BY R. E. DAHN, 1984. 6 PAGES; 2 MAP(S) (PROPERTY LOCATION; ROCK GEOCHEMICAL; SOIL GEOCHEMICAL; TILL GEOCHEMICAL)

11D/15B 53-H-94(01)

TUNGSTEN, SECOND LAKE, HALIFAX COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON PROSPECTING, AND GEOLOGICAL AND TILL GEOCHEMICAL SURVEYS, BY G. MACGILLIVRAY, 1982. 28 PAGES; 13 MAP(S) (GEOLOGICAL; METALLIC MINERAL LOCATION; PROPERTY LOCATION; ROCK SAMPLE LOCATION; TILL GEOCHEMICAL; TILL SAMPLE LOCATION)

11D/16C 21-H-23(10)

GOLD, HARRIGAN COVE, HALIFAX COUNTY, NOVA SCOTIA. HARRIGAN MINING ASSOCIATES. REPORT ON GEOLOGICAL SURVEY, BY W. A. MACPHERSON, 1982. 7 PAGES; 4 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STRUCTURAL)

11D/16C 21-H-65(01)

GOLD, SHEET HARBOUR, HALIFAX COUNTY, NOVA SCOTIA. OUTLAND RESOURCES CORPORATION. REPORT ON SOIL GEOCHEMICAL AND GROUND VLF SURVEYS, BY D. PORGERON, 1983. 21 PAGES; 7 MAP(S) (EM, GROUND; GEOLOGICAL; PROPERTY LOCATION; SOIL GEOCHEMICAL)

11E/01A 21-G-65(01)

GOLD, FINDLAY ISLAND, GUYSBOROUGH COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON GEOLOGY, AND STREAM SEDIMENT GEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 17 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11E/01B 21-G-66(01)

GOLD, GOLD MINE BROOK, GUYSBOROUGH COUNTY, NOVA SCOTIA. W. L. AMEY. PROSPECTOR'S REPORT, BY W. L. AMEY, 1983. 5 PAGES; 1 MAP(S) (PROPERTY LOCATION)

11E/02A 21-H-25(09)

GOLD, KILLAG, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR. W. LOCKERBY). REPORT ON GEOLOGY, STREAM SEDIMENT GEOCHEMICAL AND BIOGEOCHEMICAL SURVEYS, GROUND VLF, AIRBORNE VLF AND AIRBORNE MAGNETIC SURVEYS, BY C. MILLER, 1982. 14 PAGES; 7 MAP(S) (BIOGEOCHEMICAL; MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE; VLF, GROUND)

11E/02A 21-H-25(10)

GOLD, KILLAG, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR W. LOCKERBY). REPORT ON GEOLOGY, AND AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 13 PAGES; 5 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; VLF, AIRBORNE)

11E/02A 21-H-25(11)

GOLD, KILLAG, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED. REPORT ON GEOLOGICAL, BIOGEOCHEMICAL, STREAM SEDIMENT GEOCHEMICAL AND GROUND VLF SURVEYS, BY C. MILLER, 1982. 28 PAGES; 6 MAP(S) (BIOGEOCHEMICAL; GEOLOGICAL; MINE SURFACE PLANS; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, GROUND)

11E/02A 21-H-90(01)

GOLD, UNION DAM FLOWAGE, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON GEOLOGY, AND STREAM SEDIMENT GEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 17 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11E/02A 21-H-92(01)

GOLD, BEESWANGER LAKE, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON GEOLOGY, AND STREAM SEDIMENT GEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 17 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11E/02B 07-H-96(01)

BASE METALS, RIVER LAKE, HALIFAX COUNTY, NOVA SCOTIA. KIDD CREEK MINES LIMITED. REPORT ON GEOLOGICAL AND TILL GEOCHEMICAL SURVEYS, BY M. C. COREY, 1982. 4 PAGES; 4 MAP(S) (GEOLOGICAL; TILL GEOCHEMICAL; TILL SAMPLE LOCATION)

11E/02B 21-H-07(17)

GOLD, CARIBOU, HALIFAX COUNTY, NOVA SCOTIA. SHERRITT GORDON MINES LIMITED (FOR R. RANTALA). GRID LOCATION AND GROUND EM SURVEY MAPS, BY R. ATKINSON, 1982. 1 PAGES; 2 MAP(S) (EM, GROUND; PROPERTY LOCATION)

11E/02B 21-H-07(18)

GOLD, CARIBOU, HALIFAX COUNTY, NOVA SCOTIA. K. C. BURROWS. REPORT ON PROSPECTING, BY K. C. BURROWS, 1983. 2 PAGES; 2 MAP(S) (PROPERTY LOCATION)

11E/02B 21-H-74(05)

GOLD, WIRE LAKE, HALIFAX COUNTY, NOVA SCOTIA. SULPETRO MINERALS LIMITED. REPORT ON DRILLING, BY A. L. SANGSTER, 1981. 18 PAGES; 1 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS; PSEUDO SECTIONS

11E/02D 21-H-13(11)

GOLD, FIFTEEN MILE STREAM, HALIFAX COUNTY, NOVA SCOTIA. FIFTEEN MILE MINING COMPANY (FOR N. JOUDREY AND S. JOUDRIE). COMPILATION REPORT ON AVAILABLE INFORMATION AND RECOMMENDATIONS FOR AN EVALUATION PROGRAM, BY W. A. MACPHERSON, 1981. 22 PAGES; 9 MAP(S) (MINE LEVEL PLANS; MINE SURFACE PLANS; PROPERTY LOCATION); CROSS SECTIONS

11E/02D 21-H-13(12)

GOLD, FIFTEEN MILE STREAM, HALIFAX COUNTY, NOVA SCOTIA. PROSPEX INCORPORATED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON BIOGEOCHEMICAL SURVEY, BY C. MILLER, 1983. 10 PAGES; 2 MAP(S) (BIOGEOCHEMICAL; PROPERTY LOCATION)

11E/02D 21-H-13(13)

GOLD, FIFTEEN MILE STREAM, HALIFAX COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED. REPORT ON GEOLOGY AND BIOGEOCHEMICAL SURVEY, BY C. MILLER, 1982. 8 PAGES; 3 MAP(S) (BIOGEOCHEMICAL; PROPERTY LOCATION)

11E/03A 07-H-87(02)

BASE METALS, NEWCOMB CORNER, HALIFAX COUNTY, NOVA SCOTIA. BILLITON CANADA LIMITED. REPORT ON GEOLOGICAL SURVEY, BY G. MACGILLIVRAY, 1983. 7 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; METALLIC MINERAL LOCATION; PROPERTY LOCATION)

11E/03A 21-D-52(01)

GOLD, WITTENBURG, COLCHESTER COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON GEOLOGY, AND STREAM SEDIMENT GEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 19 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11E/03A 41-H-20(02)

SILICA, ELMSVALE, HALIFAX COUNTY, NOVA SCOTIA. NOVA SCOTIA SAND AND GRAVEL (FOR L. E. SHAW LIMITED). REPORT ON DRILLING, BY S. SMITH, 1982. 21 PAGES; 1 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS

11E/04A 21-I-35(03)

GOLD, RENFREW, HANTS COUNTY, NOVA SCOTIA. DAVID R. BELL GEOLOGICAL SERVICES INCORPORATED (FOR BORCAN RESOURCES LIMITED). REPORT ON DRILLING, BY D. R. BELL, 1982. 42 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; MINE SURFACE PLAN); DRILL HOLE LOGS; DRILL HOLE SECTIONS

11E/04A 41-I-62(04)

SILICA, NINEMILE RIVER, HANTS COUNTY, NOVA SCOTIA. L. E. SHAW LIMITED. REPORT ON PROSPECTING AND DRILLING, BY S. SMITH, 1982. 7 PAGES; 1 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS

11E/04A 41-I-62(05)

SILICA, NINEMILE RIVER, HANTS COUNTY, NOVA SCOTIA. L. E. SHAW LIMITED AND NOVA SCOTIA SAND AND GRAVEL (FOR L. E. SHAW LIMITED). REPORT ON PROSPECTING, BY S. SMITH, 1983. 2 PAGES; 1 MAP(S) (PROPERTY LOCATION)

11E/04B 21-I-33(10)

GOLD, CENTRAL RAWDON, HANTS COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR R. MARCHANT). REPORT ON GEOLOGY, STREAM SEDIMENT GEOCHEMICAL, AIRBORNE VLF AND AIRBORNE MAGNETIC SURVEYS, BY C. MILLER, 1982. 12 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, GROUND)

11E/04B 21-I-34(01)

GOLD, EAST RAWDON, HANTS COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR R. MARCHANT). REPORT ON GEOLOGY, AIRBORNE VLF AND AIRBORNE MAGNETIC SURVEYS, BY C. MILLER, 1982. 9 PAGES; 3 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; VLF, AIRBORNE)

11E/04D 07-I-60(02)

BASE METALS, LATTIES BROOK, HANTS COUNTY, NOVA SCOTIA. BILLITON CANADA LIMITED. REPORT ON GEOLOGICAL SURVEY, BY G. MACGILLIVRAY, 1983. 7 PAGES; 3 MAP(S) (GEOLOGICAL; METALLIC MINERAL LOCATION; PROPERTY LOCATION)

11E/05A 07-I-29(03)

BASE METALS, NOEL LAKE, HANTS COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON SOIL GEOCHEMICAL SURVEY AND OVERBURDEN DRILLING, BY B. HART, R. A. CORNISH, 1981. 185 PAGES; 6 MAP(S) (DRILL CORE GEOCHEMICAL; DRILL HOLE LOCATION; GEOLOGICAL; PROPERTY LOCATION; SOIL GEOCHEMICAL); DRILL HOLE LOGS; DRILL HOLE SECTIONS

11E/06A 07-D-41(06)

BASE METALS, SMITHFIELD, COLCHESTER COUNTY, NOVA SCOTIA. GRANGES EXPLORATION AKTIEBOLAG (FOR W. B. DUNLOP). REPORT ON GEOLOGY AND DRILLING, BY G. W. ZBITNOFF, 1982. 28 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; MINE SURFACE PLANS; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS; STRATIGRAPHIC CHARTS

11E/06A 07-D-41(07)

BASE METALS, SMITHFIELD, COLCHESTER COUNTY, NOVA SCOTIA. GRANGES EXPLORATION AKTIEBOLAG (FOR W. B. DUNLOP). REPORT ON GROUND EM SURVEY AND DRILLING, BY G. W. ZBITNOFF, 1982. 14 PAGES; 7 MAP(S) (DRILL HOLE LOCATION; EM LINES LOCATION; EM, GROUND; PROPERTY LOCATION); DRILLHOLE LOGS

11E/07A 07-G-60(04)

BASE METALS, TRAFALGAR, GUYSBOROUGH COUNTY, NOVA SCOTIA. SULPETRO MINERALS LIMITED. REPORT ON GROUND MAGNETIC AND GROUND EM SURVEYS, BY J. L. WRIGHT, 1981. 4 PAGES; 6 MAP(S) (EM, GROUND; MAGNETIC, GROUND)

11E/07A 07-G-60(05)

BASE METALS, TRAFALGAR, GUYSBOROUGH COUNTY, NOVA SCOTIA. SULPETRO MINERALS LIMITED. REPORT ON GEOLOGICAL AND ROCK GEOCHEMICAL SURVEYS, BY W. P. BINNEY, 1982. 6 PAGES; 1 MAP(S) (GEOLOGICAL; MAGNETIC, GROUND; ROCK SAMPLE LOCATION)

11E/07A 07-G-60(06)

BASE METALS, TRAFALGAR, GUYSBOROUGH COUNTY, NOVA SCOTIA. SULPETRO MINERALS LIMITED. REPORT ON TILL AND TILL HEAVY MINERALS GEOCHEMICAL SURVEYS, BY A. L. SANGSTER, 1982. 6 PAGES; 18 MAP(S) (TILL GEOCHEMICAL; TILL SAMPLE LOCATION)

11E/07B 07-D-18(11)

BASE METALS, EASTVILLE, COLCHESTER COUNTY, NOVA SCOTIA. SULPETRO MINERALS LIMITED. REPORT ON DRILLING, BY W. P. BINNEY, 1981. 48 PAGES; 10 MAP(S) (DRILL CORE GEOCHEMICAL; DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS; GEOCHEMICAL PROFILES

11E/07B 07-D-18(12)

BASE METALS, EASTVILLE, COLCHESTER COUNTY, NOVA SCOTIA. SULPETRO MINERALS LIMITED. REPORT ON GEOLOGICAL, SOIL GEOCHEMICAL, GROUND MAGNETIC AND GROUND EM SURVEYS, BY W. P. BINNEY, 1982. 5 PAGES; 7 MAP(S) (EM, GROUND; GEOLOGICAL; MAGNETIC, GROUND; SOIL GEOCHEMICAL; SOIL SAMPLE LOCATION)

11E/07D 06-M-41(01)

BARITE, LORNE STATION, PICTOU COUNTY, NOVA SCOTIA. BLUESTACK RESOURCES LIMITED. REPORT ON SOIL GEOCHEMICAL SURVEY, BY P. D. MCCULLOCH, 1983. 8 PAGES; 6 MAP(S) (PROPERTY LOCATION; SOIL GEOCHEMICAL)

11E/08B 21-G-28(05)

GOLD, LOWER CALEDONIA, GUYSBOROUGH COUNTY, NOVA SCOTIA. W. L. AMEY. PROSPECTOR'S REPORT, BY W. L. AMEY, 1983. 4 PAGES; 1 MAP(S) (PROPERTY LOCATION)

11E/08D 13-B-19(02)

COPPER, LOCHABER LAKE, ANTIGONISH COUNTY, NOVA SCOTIA. BLUESTACK RESOURCES LIMITED AND SELCO INCORPORATED (FOR J. M. PATTERSON). REPORT ON BASAL TILL GEOCHEMICAL SURVEY, BY P. D. MCCULLOCH, 1982. 16 PAGES; 3 MAP(S) (PROPERTY LOCATION; TILL GEOCHEMICAL; TILL SAMPLE LOCATION)

11E/10A 06-M-15(01)

BARITE, MCLELLAN BROOK, PICTOU COUNTY, NOVA SCOTIA. BLUESTACK RESOURCES INCORPORATED. REPORT ON GEOLOGY, SOIL AND TILL GEOCHEMICAL SURVEYS, BY P. D. MCCULLOCH, 1983. 13 PAGES; 6 MAP(S) (GEOLOGICAL; PROPERTY LOCATION; SOIL GEOCHEMICAL; TILL GEOCHEMICAL)

11E/10A 06-M-15(02)

BARITE, MCLELLAN BROOK, PICTOU COUNTY, NOVA SCOTIA. BLUESTACK RESOURCES LIMITED. REPORT ON SOIL GEOCHEMICAL SURVEY, BY P. D. MCCULLOCH, 1983. 9 PAGES; 6 MAP(S) (GEOLOGICAL; PROPERTY LOCATION; SOIL GEOCHEMICAL)

11E/10A 07-M-42(01)

BASE METALS, PINE TREE, PICTOU COUNTY, NOVA SCOTIA. BLUESTACK RESOURCES LIMITED. REPORT ON GEOLOGY AND SOIL GEOCHEMICAL SURVEY, BY P. D. MCCULLOCH, 1983. 12 PAGES; 13 MAP(S) (GEOLOGICAL; PROPERTY LOCATION; SOIL GEOCHEMICAL)

11E/12B 21-E-55(01)

GOLD, WILLIAMSDALE, CUMBERLAND COUNTY, NOVA SCOTIA. U. S. BORAX (FOR M. CULLEN). REPORT ON ROCK, SOIL AND STREAM SEDIMENT GEOCHEMICAL SURVEYS, BY W. B. BURTON, M. CULLEN, 1982. 17 PAGES; 12 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; PIT LOCATION; ROCK SAMPLE LOCATION; SOIL GEOCHEMICAL; STREAM SEDIMENT GEOCHEMICAL)

11F/04A 21-G-61(02)

GOLD, OFFSHORE COUNTRY HARBOUR, GUYSBOROUGH COUNTY, NOVA SCOTIA. NOVA SCOTIA RESEARCH FOUNDATION (FOR SEABRIGHT RESOURCES INCORPORATED). REPORT ON MARINE SUBBOTTOM SEISMIC PROFILING SURVEY, BY A. G. MCKAY, C. SCHAFER, 1981. 55 PAGES; 5 MAP(S) (MARINE SEDIMENT THICKNESS; MARINE SEDIMENT TYPE; SEISMIC, MARINE; STUDY AREA LOCATION); CROSS SECTIONS; SUBBOTTOM PROFILES

11F/04B 21-G-66(01)

GOLD, GEGOGAN HARBOUR, GUYSBOROUGH COUNTY, NOVA SCOTIA. PAN EAST RESOURCES INCORPORATED AND SANDER GEOPHYSICS LIMITED (FOR PAN EAST RESOURCES INCORPORATED). REPORT ON GEOLOGY, AND PROSPECTING, STREAM SEDIMENT GEOCHEMICAL, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS, BY C. MILLER, 1982. 17 PAGES; 6 MAP(S) (MAGNETIC, AIRBORNE; PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, AIRBORNE)

11F/04D 21-G-27(09)

GOLD, LOWER SEAL HARBOUR, GUYSBOROUGH COUNTY, NOVA SCOTIA. NORTHGATE EXPLORATION LIMITED (FOR M. MACMILLAN). REPORT ON GROUND MAGNETIC AND GROUND VLF SURVEYS, BY T. N. MCKILLEN, 1982. 1 PAGES; 2 MAP(S) (MAGNETIC, GROUND; PROPERTY LOCATION; VLF, GROUND)

11F/04D 21-G-54(08)

GOLD, UPPER SEAL HARBOUR, GUYSBOROUGH COUNTY, NOVA SCOTIA. PATINO MINES (QUEBEC) LIMITED (FOR M. MACMILLAN). REPORT ON GROUND MAGNETIC AND GROUND VLF SURVEYS, BY D. R. SCAMMELL, 1981. 15 PAGES; 7 MAP(S) (MAGNETIC, GROUND; PROPERTY LOCATION; VLF, GROUND)

11F/04D 21-G-54(09)

GOLD, ISAACS HARBOUR, GUYSBOROUGH COUNTY, NOVA SCOTIA. PATINO MINES (QUEBEC) LIMITED. REPORT ON GROUND MAGNETIC AND GROUND VLF SURVEYS, BY D. R. SCAMMELL, 1982. 13 PAGES; 15 MAP(S) (MAGNETIC, GROUND; PROPERTY LOCATION; VLF, GROUND)

11F/05A 21-G-13(01)

GOLD, FOREST HILL, GUYSBOROUGH COUNTY, NOVA SCOTIA. B AND F EXPLORATIONS. REPORT ON GEOLOGY, ROCK AND SOIL GEOCHEMICAL SURVEYS, AND GROUND MAGNETIC AND GROUND EM SURVEYS AND TRENCHING, BY W. HESHKA, 1983. 16 PAGES

11F/05A 51-G-42(01)

TIN, SANGSTER LAKE, GUYSBOROUGH COUNTY, NOVA SCOTIA. KIDD CREEK MINES LIMITED. REPORT ON GEOLOGICAL, ROCK, TILL, TILL HEAVY MINERALS AND SOIL GEOCHEMICAL SURVEYS, BY D. R. DUNCAN, 1983. 24 PAGES; 3 MAP(S) (GEOLOGICAL; PROPERTY LOCATION; RADIOMETRIC, AIRBORNE; ROCK SAMPLE LOCATION; SOIL GEOCHEMICAL; TILL GEOCHEMICAL)

11F/05B 21-G-13(17)

GOLD, FOREST HILL, GUYSBOROUGH COUNTY, NOVA SCOTIA. SEABRIGHT RESOURCES INCORPORATED, ECOLOGICAL AND RESOURCES CONSULTANTS LIMITED AND J. E. DAWE (FOR K. TEASDALE). REPORT ON MINING HISTORY, GEOLOGY, AND ROCK, TAILINGS AND TILL GEOCHEMISTRY AND PROPOSED DEVELOPMENT RECOMMENDATIONS, BY W. E. HALE, J. E. DAWE, 1982. 119 PAGES; 26 MAP(S) (GEOLOGICAL; MAGNETIC, AIRBORNE; MINE SURFACE PLANS; PROPERTY LOCATION; ROCK GEOCHEMICAL; TAILINGS LOCATION; TAILINGS SAMPLE LOCATION); CROSS SECTIONS; PHOTOGRAPHS

11F/05B 21-G-13(18)

GOLD, FOREST HILL, GUYSBOROUGH COUNTY, NOVA SCOTIA. H. M. PARRINGTON (FOR H. M. RICHARDSON). REPORT ON HISTORY AND PRODUCTION, BULK SAMPLING AND DEVELOPMENT RECOMMENDATIONS, BY H. M. PARRINGTON, 1938. 16 PAGES

11F/05B 21-G-13(19)

GOLD, FOREST HILL (MILE LAKE), GUYSBOROUGH COUNTY, NOVA SCOTIA. INTERNATIONAL GEOCHEMICAL ASSOCIATES LIMITED AND ENTREPRENEURIAL MANAGEMENT LIMITED (FOR LOUISBOURG PROPERTY HOLDINGS LTD., BARTECH DEVELOPMENTS INC., INTERNATIONAL GEOCHEMICAL ASSOCIATES LTD. AND M. RIDDELL). REPORT ON GEOLOGY, MINE DEVELOPMENT, PRODUCTION AND MILL TESTS, BY J. E. RIDDELL, 1982. 90 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; MAGNETIC, GROUND; MINE SURFACE PLANS; TILL GEOCHEMICAL)

11F/11D 07-O-71(01)

BASE METALS, KEMPT ROAD, RICHMOND COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED. REPORT ON DRILLING, BY J. L. MACLEOD, 1979. 6 PAGES; 1 MAP(S) (DRILL HOLE LOCATION); DRILL HOLE LOGS

11F/14B 28-J-23(04)

LIMESTONE, GLENDALE, INVERNESS COUNTY, NOVA SCOTIA. KELROCK LIMITED. REPORT ON GEOLOGICAL EVALUATION, ROCK GEOCHEMISTRY AND ORE RESERVES, BY W. S. SHAW, D. J. MACNEIL, 1981. 21 PAGES; 3 MAP(S) (GEOLOGICAL; ORE RESERVES; PROPERTY LOCATION; ROCK SAMPLE LOCATION; TOPOGRAPHIC); CROSS SECTIONS

11F/14D 40-J-77(05)

POTASH, ASHFIELD, INVERNESS COUNTY, NOVA SCOTIA. NORANDA EXPLORATION COMPANY LIMITED. REPORT ON DRILLING, BY P. COOPER, 1982. 60 PAGES; 2 MAP(S) (DRILL HOLE LOCATION); CALIPER LOGS; DENSITY LOGS; DIPMETER LOGS; DRILL HOLE LOGS; GAMMA RAY LOGS; NEUTRON LOGS; STRATIGRAPHIC COLUMNS

11F/14D 53-J-59(02)

TUNGSTEN, WHYCOCOMAGH, INVERNESS COUNTY, NOVA SCOTIA. M.E.X. EXPLORATIONS LIMITED. REPORT ON GEOLOGICAL AND SOIL GEOCHEMICAL SURVEYS AND DRILLING, BY D. L. BLACK, 1982. 117 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; SOIL GEOCHEMICAL); DRILL HOLE LOGS; DRILL HOLE SECTIONS

11F/14D 53-J-59(03)

TUNGSTEN, WHYCOCOMAGH, INVERNESS COUNTY, NOVA SCOTIA. M.E.X. EXPLORATIONS LIMITED (FOR M.E.X. EXPLORATIONS LIMITED AND CAPE BRETON DEVELOPMENT CORPORATION). REPORT ON DRILLING AND SOIL GEOCHEMISTRY, BY D. L. BLACK, 1982. 131 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; SOIL GEOCHEMICAL); DRILL HOLE LOGS; DRILL HOLE SECTIONS

11F/16B 27-C-83(18)

LEAD, SILVER MINE, CAPE BRETON COUNTY, NOVA SCOTIA. GEOPROBE LIMITED (FOR BARYMIN EXPLORATIONS LIMITED AND YAVA MINES LIMITED). REPORT ON A GROUND EM SURVEY AND A GROUND IP-RESISTIVITY SURVEY, BY M. K. GHOSH, 1980. 23 PAGES; 1 MAP(S) (EM LINES LOCATION); CROSS SECTIONS; EM PROFILES; PSEUDO SECTIONS; RESISTIVITY PROFILES

11F/16D 07-C-31(11)

BASE METALS, DEEP COVE, CAPE BRETON COUNTY, NOVA SCOTIA. AMAX MINERALS EXPLORATION (FOR LOUISBOURG PROPERTY HOLDINGS). DRILL HOLE LOGS, BY AMAX MINERALS EXPLORATION, 1981. 8 PAGES; 1 MAP(S) (PROPERTY LOCATION); DRILL HOLE LOGS

11F/16D 07-C-31(12)

BASE METALS, DEEP COVE, CAPE BRETON COUNTY, NOVA SCOTIA. AMAX MINERALS EXPLORATION LIMITED (FOR LOUISBOURG PROPERTY HOLDINGS LIMITED). REPORT ON GEOLOGICAL, IP/RESISTIVITY, GROUND MAGNETIC AND GROUND GRAVITY SURVEYS AND DRILLING, BY S. SEARS, A. WATTS, G. COVEY, C. CERMIGNANI, K. LOVSTROM, 1982. 209 PAGES; 11 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; MAGNETIC, GROUND; METALLIC MINERAL LOCATION; PROPERTY LOCATION; RESISTIVITY); DRILL HOLE LOGS; DRILL HOLE SECTIONS; GRAVITY PROFILES; MAGNETIC PROFILES; PHOTOGRAPHS; PHOTOMICROGRAPHS; PSEUDO SECTIONS

11F/16D 07-C-40(10)

BASE METALS, FRENCH ROAD, CAPE BRETON COUNTY, NOVA SCOTIA. FRENCH ROAD EXPLORATIONS. REPORT ON GEOLOGY, ROCK GEOCHEMISTRY, TRENCHING AND DRILLING, BY D. FORGERON, 1981. 47 PAGES; 5 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; METALLIC MINERAL LOCATION; PROPERTY LOCATION; SOIL GEOCHEMICAL); CROSS SECTIONS; DRILL HOLE LOGS

11F/16D 07-C-40(11)

BASE METALS, FRENCH ROAD, CAPE BRETON COUNTY, NOVA SCOTIA. J. E. RIDDELL. DRILL HOLE LOGS, BY J. E. RIDDELL, 1981. 2 PAGES; 1 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; METALLIC MINERAL LOCATION); DRILL HOLE LOGS

11K/01B 07-C-53(01)

BASE METALS, GLEN MORRISON, CAPE BRETON COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED. REPORT ON DRILLING, BY P. HANNON, 1972. 10 PAGES; 1 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL); DRILL HOLE LOGS

11K/02C 21-Q-12(14)

GOLD, MIDDLE RIVER, VICTORIA COUNTY, NOVA SCOTIA. DOME EXPLORATION (CANADA) LIMITED (FOR GOLD BROOK DEVELOPMENTS LIMITED). REPORT ON SOIL AND ROCK GEOCHEMICAL SURVEYS AND DRILLING, BY C. G. JOHNSON, 1982. 52 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; PIT LOCATION; PROPERTY LOCATION; ROCK GEOCHEMICAL; SOIL GEOCHEMICAL); DRILL HOLE LOGS; DRILL HOLE SECTIONS; GEOCHEMICAL PROFILES

11K/03D 06-J-90(01)

BARITE, MOUNT PLEASANT, INVERNESS COUNTY, NOVA SCOTIA. CCH MINERALS LIMITED. REPORT ON GEOLOGICAL AND SOIL GEOCHEMICAL SURVEYS, BY P. POTAPOFF, 1982. 10 PAGES; 3 MAP(S) (GEOLOGICAL; PROPERTY LOCATION; SOIL GEOCHEMICAL)

11K/07B 07-Q-24(04)

BASE METALS, SARACH BROOK, VICTORIA COUNTY, NOVA SCOTIA. SULPETRO MINERALS LIMITED. REPORT ON GROUND EM AND GROUND MAGNETIC SURVEYS, BY J. L. WRIGHT, 1981. 12 PAGES; 3 MAP(S) (EM, GROUND; MAGNETIC, GROUND); EM PROFILES; MAGNETIC PROFILES

11E/07B 07-Q-24(05)

BASE METALS, SARACH BROOK, VICTORIA COUNTY, NOVA SCOTIA. SULPETRO MINERALS LIMITED. REPORT ON DRILLING, BY A. L. SANGSTER, 1981. 14 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; SOIL GEOCHEMICAL; VLF, GROUND); DRILL HOLE LOGS; DRILL HOLE SECTIONS

11E/16C 10-Q-01(01)

COAL, ASPY BAY, VICTORIA COUNTY, NOVA SCOTIA. GEOTERREX LIMITED (FOR PETRO CANADA INCORPORATED). REPORT ON GEOLOGY AND MARINE SEISMIC SURVEY, BY G. FORTIN, L. GODARD, 1981. 169 PAGES; 11 MAP(S) (BATHYMETRIC; CROSS SECTION LOCATION; ISOPACHS; MARINE SEDIMENT THICKNESS; MARINE SEDIMENT TYPE; PROPERTY LOCATION; SHIP TRACK LOCATION; STRUCTURAL); CROSS SECTIONS; SEISMIC RECORDS; SEISMIC SECTIONS

20P/13C 29-R-02(02)

LITHIUM, BRAZIL LAKE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON GEOLOGICAL, TILL AND ROCK GEOCHEMICAL SURVEYS, GROUND MAGNETIC AND GROUND VLF SURVEYS, BY V. V. PALMA, P. E. SINCLAIR, H. E. HUTCHINSON, R. L. KOHLSMITH, 1982. 13 PAGES; 8 MAP(S) (GEOLOGICAL; MAGNETIC, GROUND; PROPERTY LOCATION; ROCK SAMPLE LOCATION; TILL SAMPLE LOCATION; VLF, GROUND); STRATIGRAPHIC CHARTS

20P/13C 51-R-10(02)

TIN, TUSKET, YARMOUTH COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED (FOR ESSO RESOURCES CANADA LIMITED, KERR ADDISON MINES LIMITED AND DOME EXPLORATION LIMITED). REPORT ON GEOLOGICAL, TILL AND HEAVY MINERALS GEOCHEMICAL SURVEYS AND DRILLING, BY J. L. MACLEOD, 1982. 265 PAGES; 18 MAP(S) (DRILL CORE GEOCHEMICAL; DRILL HOLE LOCATION; HEAVY MINERALS GEOCHEMICAL; PROPERTY LOCATION; STREAM SEDIMENT GEOCHEMICAL; TILL GEOCHEMICAL); DRILL HOLE LOGS; DRILL HOLE SECTIONS; HISTOGRAMS

20P/14C 51-P-11(01)

TIN, UPPER OHIO, SHELBURNE COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED, KERR ADDISON MINES LIMITED AND DOME EXPLORATION LIMITED (FOR ESSO RESOURCES CANADA LIMITED). REPORT ON TILL AND STREAM SEDIMENT HEAVY MINERALS GEOCHEMICAL SURVEYS, BY J. L. MACLEOD, 1982. 24 PAGES; 2 MAP(S) (HEAVY MINERALS GEOCHEMICAL; PROPERTY LOCATION; TILL GEOCHEMICAL)

21A/04A 51-R-25(14)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON OVERBURDEN DRILLING, BY P. SINCLAIR, 1982. 19 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS

21A/04A 51-R-25(15)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON OVERBURDEN DRILLING, BY P. SINCLAIR, 1982. 34 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS

21A/04A 51-R-25(16)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON OVERBURDEN DRILLING, BY P. SINCLAIR, 1982. 22 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS

21A/04A 51-R-25(17)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON OVERBURDEN DRILLING, BY P. SINCLAIR, 1982. 38 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS

21A/04A 51-R-25(18)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON OVERBURDEN DRILLING, BY P. SINCLAIR, 1982. 27 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS

21A/04A 51-R-25(19)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED AND EASTERN GEOPHYSICS LIMITED (FOR SHELL CANADA RESOURCES LIMITED). REPORT ON GROUND GRAVITY SURVEY, BY P. M. DUNCAN, P. J. MUISE, 1982. 18 PAGES; 6 MAP(S) (GRAVITY, GROUND; PROPERTY LOCATION)

21A/04A 51-R-25(20)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON DRILLING, BY P. M. DUNCAN, R. L. KOHLSMITH, S. G. WELLS, 1982. 36 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS

21A/04A 51-R-25(21)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON DRILLING, BY P. M. DUNCAN, R. L. KOHLSMITH, S. G. WELLS, 1982. 51 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS

21A/04A 51-R-25(22)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON DRILLING, BY P. M. DUNCAN, R. L. KOHLSMITH, S. G. WELLS, 1982. 258 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS

21A/04B 51-R-25(04)

TIN, EAST KEMPTVILLE, YARMOUTH COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON DRILLING, BY P. M. DUNCAN, R. H. KOHLSMITH, S. G. WELLS, 1982. 36 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS

21A/04B 51-R-28(01)

TIN, PEARL LAKE, YARMOUTH COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED. REPORT ON DRILLING, BY J. L. MACLEOD, 1982. 108 PAGES; 2 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS

21A/04B 51-R-28(02)

TIN, PEARL LAKE, YARMOUTH COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED. REPORT ON IP, GROUND EM AND GROUND MAGNETIC SURVEYS, BY Z. DOBORZYNSKI, 1982. 8 PAGES; 4 MAP(S) (EM, GROUND; IP; MAGNETIC, GROUND); PSEUDO SECTIONS

21A/04D 51-R-34(01)

TIN, HANNAH LAKE, YARMOUTH COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED (FOR ESSO RESOURCES CANADA LIMITED, DOME EXPLORATION LIMITED AND KERR ADDISON MINES LIMITED). REPORT ON TILL HEAVY MINERALS AND STREAM SEDIMENT HEAVY MINERALS GEOCHEMICAL SURVEYS, BY J. L. MACLEOD, 1982. 23 PAGES; 2 MAP(S) (PROPERTY LOCATION; STREAM SEDIMENT SAMPLE LOCATION; TILL GEOCHEMICAL)

21A/04D 51-R-34(02)

TIN, HANNAH LAKE, YARMOUTH COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED (FOR ESSO RESOURCES CANADA LIMITED, KERR ADDISON MINES LIMITED AND DOME EXPLORATION CANADA LIMITED). REPORT ON GEOLOGICAL AND TILL GEOCHEMICAL SURVEY, BY J. L. MACLEOD, 1983. 29 PAGES; 4 MAP(S) (GEOLOGICAL; PROPERTY LOCATION; TILL GEOCHEMICAL)

21A/06A 21-H-26(09)

GOLD, WHITEBURN, QUEENS COUNTY, NOVA SCOTIA. WHITEBURN PRECIOUS METALS LIMITED (FOR A. THOMPSON, M. RIDDELL AND ENTREPRENEURIAL MANAGEMENT LIMITED). REPORT ON GEOLOGY, AND BIOGEOCHEMICAL, ROCK AND STREAM SEDIMENT GEOCHEMICAL SURVEYS, AND DEVELOPMENT EVALUATION AND RECOMMENDATIONS, BY W. A. MACPHERSON, 1982. 31 PAGES; 7 MAP(S) (BIOGEOCHEMICAL; MINE SURFACE PLANS; PROPERTY LOCATION; ROCK GEOCHEMICAL; STREAM SEDIMENT GEOCHEMICAL)

21A/06A 21-H-26(10)

GOLD, WHITEBURN, QUEENS COUNTY, NOVA SCOTIA. JOHN A. LESLIE AND ASSOCIATES LIMITED (FOR NOVEX RESOURCES LIMITED). REPORT ON PROSPECTING, SOIL GEOCHEMICAL AND BIOGEOCHEMICAL SURVEYS, BY J. A. LESLIE, 1983. 8 PAGES; 7 MAP(S) (BIOGEOCHEMICAL; PROPERTY LOCATION; SOIL GEOCHEMICAL)

21A/06A 51-H-06(03)

TIN, CALEDONIA, QUEENS COUNTY, NOVA SCOTIA. EASTERN GEOPHYSICS LIMITED AND SHELL CANADA RESOURCES LIMITED (FOR SHELL CANADA RESOURCES LIMITED). REPORT ON GROUND GRAVITY SURVEY, BY G. MACGILLIVRAY, 1982. 11 PAGES; 4 MAP(S) (GRAVITY, GROUND; PROPERTY LOCATION)

21A/06D 51-H-06(02)

TIN, CALEDONIA, QUEENS COUNTY, NOVA SCOTIA. EASTERN GEOPHYSICS LIMITED AND BILLITON CANADA LIMITED (FOR BILLITON CANADA LIMITED). REPORT ON GROUND GRAVITY SURVEY, BY G. MACGILLIVRAY, 1982. 7 PAGES; 5 MAP(S) (GRAVITY, GROUND; PROPERTY LOCATION; TOPOGRAPHIC)

21A/07B 21-H-11(18)

GOLD, MOLEGA, QUEENS COUNTY, NOVA SCOTIA. J. E. DAWE (FOR F. RHODENIZER). SUMMARY REPORT ON 1970 AND 1972 EXPLORATION PROGRAMS AND RECOMMENDATIONS, BY J. E. DAWE, 1974. 5 PAGES

21A/07B 21-H-11(19)

GOLD, MOLEGA, QUEENS COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED (FOR F. RHODENIZER). REPORT ON SURFACE EXAMINATION AND PROPOSED DEVELOPMENT PROGRAM, BY J. L. MACLEOD, 1979. 5 PAGES

21A/07B 21-H-11(20)

GOLD, MOLEGA, QUEENS COUNTY, NOVA SCOTIA. W. A. MACPHERSON AND LAKEFIELD RESEARCH OF CANADA LIMITED (FOR F. RHODENIZER). REPORT ON DRILLING, BY W. A. MACPHERSON, R. G. WILLIAMSON, 1980. 11 PAGES; 2 MAP(S) (DRILL HOLE LOCATION); DRILL HOLE SECTIONS

21A/07B 21-H-11(21)

GOLD, MOLEGA, QUEENS COUNTY, NOVA SCOTIA. W. A. MACPHERSON (FOR F. RHODENIZER). REPORT ON GEOLOGY, MINING AND EXPLORATION HISTORY AND PAST DRILLING, BY W. A. MACPHERSON, 1981. 18 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION)

21A/07C 21-L-25(09)

GOLD, PLEASANT RIVER BARRENS, LUNENBURG COUNTY, NOVA SCOTIA. HIPOCKETS EXPLORATION LIMITED. LETTER DESCRIBING TRENCHING ACTIVITIES, BY T. D. BOUDREAU, 1983. 3 PAGES; 1 MAP(S) (PROPERTY LOCATION); PHOTOGRAPHS

21A/08C 21-L-03(09)

GOLD, BLOCKHOUSE, LUNENBURG COUNTY, NOVA SCOTIA. JAMES E. TILSEY AND ASSOCIATES LIMITED (FOR BLOCKHOUSE RESOURCES LIMITED AND W. LOCKERBY). REPORT ON GEOLOGY, MINING HISTORY, SAMPLING TECHNIQUES AND PROPOSED EXPLORATION PROGRAM, BY J. E. TILSEY, 1982. 34 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; MINE LEVEL PLANS; MINE SURFACE PLANS; PROPERTY LOCATION)

21A/09B 51-L-53(01)

TIN, MARTIN RIVER LAKE (SPONDO LAKE), LUNENBURG COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED. REPORT ON GEOLOGICAL AND TILL AND STREAM SEDIMENT HEAVY MINERALS GEOCHEMICAL SURVEYS, BY J. L. MACLEOD, 1982. 21 PAGES; 3 MAP(S) (GEOLOGICAL; HEAVY MINERALS GEOCHEMICAL; PROPERTY LOCATION; STREAM SEDIMENT GEOCHEMICAL; TILL GEOCHEMICAL)

21A/09C 51-L-39(03)

TIN, MILLET LAKE, LUNENBURG COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED AND EASTERN GEOPHYSICS LIMITED (FOR SHELL CANADA RESOURCES LIMITED AND ELDORADO NUCLEAR LIMITED). REPORT ON GROUND GRAVITY SURVEY, BY G. MACGILLIVRAY, 1981. 9 PAGES; 4 MAP(S) (GRAVITY, GROUND; PROPERTY LOCATION)

21A/10A 51-L-54(01)

TIN, WHALE LAKE, LUNENBURG COUNTY, NOVA SCOTIA. KIDD CREEK MINES LIMITED. REPORT ON GEOLOGICAL, SOIL, TILL AND ROCK GEOCHEMICAL SURVEYS, IP, AIRBORNE VLF, AIRBORNE EM AND AIRBORNE MAGNETIC SURVEYS, BY M. C. COREY, 1982. 23 PAGES; 9 MAP(S) (EM, AIRBORNE; GEOLOGICAL; MAGNETIC, AIRBORNE; PROPERTY LOCATION; ROCK SAMPLE LOCATION; SOIL SAMPLE LOCATION; TILL SAMPLE LOCATION; VLF, AIRBORNE); IP PROFILES; PSEUDO SECTIONS

21A/10A 51-L-54(02)

TIN, WHALE LAKE, LUNENBURG COUNTY, NOVA SCOTIA. KIDD CREEK MINES LIMITED AND AERODAT LIMITED (FOR KIDD CREEK MINES LIMITED). REPORT ON TILL AND SOIL GEOCHEMICAL SURVEYS, AIRBORNE MAGNETIC AND AIRBORNE VLF SURVEYS , BY M. C. COREY, 1982. 11 PAGES; 9 MAP(S) (EM, AIRBORNE; MAGNETIC, AIRBORNE; PROPERTY LOCATION; SOIL SAMPLE LOCATION; TILL SAMPLE LOCATION)

21A/10A 54-L-54(01)

URANIUM, WHALE LAKE, LUNENBURG COUNTY, NOVA SCOTIA. AQUITAINE COMPANY OF CANADA LIMITED. REPORT ON GEOLOGICAL, ROCK, SOIL AND TILL GEOCHEMICAL SURVEYS AND GROUND AND AIRBORNE RADIOMETRIC SURVEYS, BY D. W. POLLOCK, 1982. 39 PAGES; 13 MAP(S) (GEOLOGICAL; RADIOMETRIC, AIRBORNE; RADIOMETRIC, GROUND; ROCK SAMPLE LOCATION; SOIL GEOCHEMICAL; TILL GEOCHEMICAL); GEOCHEMICAL PROFILES

21A/10B 07-A-28(01)

BASE METALS, ROUND LAKE, ANNAPOLIS COUNTY, NOVA SCOTIA. J. A. LESLIE (FOR HIPOCKETS EXPLORATION LIMITED). REPORT ON ROCK, SOIL, STREAM SEDIMENT, LAKE SEDIMENT AND BEACH SAND GEOCHEMICAL SURVEYS AND GROUND VLF SURVEYS, BY J. A. LESLIE, 1982. 11 PAGES; 4 MAP(S) (BEACH SAND SAMPLE LOCATION; LAKE SEDIMENT SAMPLE LOCATION; PROPERTY LOCATION; ROCK SAMPLE LOCATION; SOIL SAMPLE LOCATION; STREAM SEDIMENT SAMPLE LOCATION; VLF, GROUND)

21A/10C 51-A-23(01)

TIN, FALKLAND RIDGE, ANNAPOLIS COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON OVERBURDEN DRILLING, BY G. MACGILLIVRAY, 1982. 20 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; PROPERTY LOCATION); DRILL HOLE LOGS; DRILL HOLE SECTIONS

21A/10C 51-K-28(01)

TIN, EAST DALHOUSIE, KINGS COUNTY, NOVA SCOTIA. SHELL CANADA RESOURCES LIMITED. REPORT ON GEOLOGICAL, TILL AND ROCK GEOCHEMICAL SURVEYS, BY G. MACGILLIVRAY, 1982. 10 PAGES; 5 MAP(S) (GEOLOGICAL; METALLIC MINERAL LOCATION; PROPERTY LOCATION; ROCK SAMPLE LOCATION; TILL GEOCHEMICAL)

21A/10C 51-K-28(02)

TIN, EAST DALHOUSIE, KINGS COUNTY, NOVA SCOTIA. ESSO RESOURCES CANADA LIMITED. REPORT ON GEOLOGICAL, TILL, STREAM SEDIMENT AND ROCK GEOCHEMICAL SURVEYS, BY J. L. MACLEOD, 1982. 25 PAGES; 3 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; METALLIC MINERAL LOCATION; PROPERTY LOCATION; STREAM SEDIMENT GEOCHEMICAL; TILL GEOCHEMICAL)

21A/16B 31-L-19(21)

MANGANESE, NEW ROSS, LUNENBURG COUNTY, NOVA SCOTIA. KIDD CREEK MINES LIMITED. COMPILATION REPORT ON GEOLOGY, MINING AND EXPLORATION HISTORY, ORE GEOCHEMISTRY AND PROPOSED DRILLING; AND COMPARISONS WITH SOUTHWESTERN UNITED STATES; CORNWALL, ENGLAND AND WALTON, NOVA SCOTIA MANGANESE DEPOSITS, BY M. GRAVES, 1982. 67 PAGES; 9 MAP(S) (DRILL HOLE LOCATION; GEOLOGICAL; LINEAMENTS; METALLOGENIC; MINE LEVEL PLANS; PROPERTY LOCATION); BLOCK DIAGRAMS; CROSS SECTIONS; RESISTIVITY PROFILES

21A/16B 31-L-19(22)

MANGANESE, NEW ROSS, LUNENBURG COUNTY, NOVA SCOTIA. KIDD CREEK MINES LIMITED. REPORT ON ORE, ROCK, GROUNDWATER AND STREAM WATER GEOCHEMISTRY AND A TILL GEOCHEMICAL SURVEY, BY M. GRAVES, 1983. 22 PAGES; 5 MAP(S) (PROPERTY LOCATION; STREAM WATER SAMPLE LOCATION; TILL GEOCHEMICAL)

21A/16B 31-L-19(23)

MANGANESE, NEW ROSS, LUNENBURG COUNTY, NOVA SCOTIA. KIDD CREEK MINES LIMITED. REPORT ON TRENCHING AND GEOLOGY, BY D. R. DUNCAN, 1983. 14 PAGES; 4 MAP(S) (GEOLOGICAL; MINE SURFACE PLANS; PROPERTY LOCATION); CROSS SECTIONS

21A/16B 51-L-38(01)

TIN, WALLABACK LAKE, LUNENBURG COUNTY, NOVA SCOTIA. KIDD CREEK MINES LIMITED. REPORT ON GEOLOGY, SOIL AND TILL HEAVY MINERALS GEOCHEMICAL SURVEYS, AND GROUND VLF, GROUND MAGNETIC, IP AND RESISTIVITY SURVEYS, BY D. R. DUNCAN, P. K. SARKAR, 1983. 40 PAGES; 7 MAP(S) (GEOLOGICAL; GEOPHYSICAL SURVEYS INDEX; METALLIC MINERAL LOCATION; PROPERTY LOCATION; SOIL SAMPLE LOCATION; TILL SAMPLE LOCATION); CROSS SECTIONS; MAGNETIC PROFILES; RESISTIVITY PROFILES; VLF PROFILES

21B/08A 07-F-15(01)

BASE METALS, SPECTACLE LAKE, DIGBY COUNTY, NOVA SCOTIA. RIOCANEX LIMITED. REPORT ON SOIL AND LAKE SEDIMENT GEOCHEMICAL SURVEYS, BY V. ARSENEAU, 1981. 4PAGES; 2 MAP(S) (LAKE SEDIMENT SAMPLE LOCATION; PROPERTY LOCATION; SOIL SAMPLE LOCATION)

21H/01A 07-I-20(01)

BASE METALS, LOWER BURLINGTON, HANTS COUNTY, NOVA SCOTIA. PREUVIER MINES LIMITED AND NOVA SCOTIA RESEARCH FOUNDATION (FOR M.E.X. EXPLORATIONS LIMITED). REPORT ON SOIL GEOCHEMICAL, GROUND MAGNETIC, GROUND GRAVITY AND SP SURVEYS, BY D. L. BLACK, 1982. 9 PAGES; 12 MAP(S) (GRAVITY, GROUND; MAGNETIC, GROUND; PROPERTY LOCATION; SP; SOIL GEOCHEMICAL; TOPOGRAPHIC)

21H/01A 07-I-40(04)

BASE METALS, SUMMERVILLE, HANTS COUNTY, NOVA SCOTIA. PREUVIER MINES LIMITED (FOR PREUVIER MINES LIMITED AND M.E.X. EXPLORATIONS LIMITED). REPORT ON SOIL GEOCHEMICAL SURVEY, BY D. L. BLACK, 1982. 8 PAGES; 9 MAP(S) (GRAVITY, GROUND; PROPERTY LOCATION; SP; SOIL GEOCHEMICAL)

21H/01D 07-I-05(04)

BASE METALS, CHEVERIE, HANTS COUNTY, NOVA SCOTIA. PREUVIER MINES LIMITED. REPORT ON SOIL GEOCHEMICAL, SP AND GROUND EM SURVEYS, BY D. L. BLACK, 1982. 4 PAGES; 8 MAP(S) (EM, GROUND; PROPERTY LOCATION; SP; SOIL GEOCHEMICAL)

21H/01D 07-I-15(08)

BASE METALS, GOSHEN, HANTS COUNTY, NOVA SCOTIA. PREUVIER MINES LIMITED. REPORT ON SOIL GEOCHEMICAL, SP AND GROUND EM SURVEYS AND DRILLING, BY D. L. BLACK, 1981. 22 PAGES; 25 MAP(S) (DRILL HOLE LOCATION; EM, GROUND; PROPERTY LOCATION; SP; SOIL GEOCHEMICAL); DRILL HOLE LOGS

APPENDIX II

OPEN FILE REPORTS FOR 1984

OPEN FILE REPORTS FOR 1984

572

SUBMISSION TO LEGISLATIVE COMMITTEE ON MINES AND ENERGY ON EXPLORATION/MINING ACTIVITY IN NOVA SCOTIA FOR 1980, BY NOVA SCOTIA DEPARTMENT OF MINES+ENERGY, 1981. 121 PAGES; 14 MAP(S) (COALFIELD LOCATION; EXPLORATION ACTIVITY LOCATION; INDUSTRIAL MINERAL LOCATION; METALLIC MINERAL LOCATION; PEAT DEPOSIT LOCATION; WELL HOLE LOCATION); MINING PRODUCTION GRAPHS

573

SUBMISSION TO LEGISLATIVE COMMITTEE ON MINES AND ENERGY ON EXPLORATION/MINING ACTIVITY IN NOVA SCOTIA FOR 1981, BY NOVA SCOTIA DEPARTMENT OF MINES+ENERGY, 1982. 132 PAGES; 18 MAP(S) (COALFIELD LOCATION; EXPLORATION ACTIVITY LOCATION; INDUSTRIAL MINERAL LOCATION; METALLIC MINERAL LOCATION; PEAT DEPOSIT LOCATION; WELL HOLE LOCATION); MINING PRODUCTION GRAPHS

574

MINERAL DEVELOPMENT DIVISION DRILL CORE CATALOGUE, BY J. LANGILLE, 1983. 10 PAGES

575

REPORT ON NUMBER 3 SEAM INVESTIGATION, NOVACO OPEN PIT MINE, SPRINGHILL COALFIELD, NOVA SCOTIA, BY J. H. CALDER, 1983. 30 PAGES; 1 MAP(S) (DRILL HOLE LOCATION; STRUCTURAL); DENSITY LOGS; DRILL HOLE LOGS; DRILL HOLE SECTIONS; GAMMA RAY LOGS

576

COAL IN THE MAPLE BROOK SYNCLINE, INVERNESS COUNTY, NOVA SCOTIA, BY D. J. MACNEIL, 1983. 10 PAGES; 1 MAP(S) (ADIT LOCATION; GEOLOGICAL)

578

STRUCTURAL FEATURES OF THE SPRINGHILL COALFIELD WITH NOTES ON THE GEOLOGY AND MINING HISTORY, BY J. H. CALDER, 1983. 57 PAGES; 4 MAP(S) (COAL SEAM LOCATION; DRILL HOLE LOCATION; STRUCTURAL); CROSS SECTIONS; PHOTOGRAPHS; STRATIGRAPHIC COLUMNS; STRUCTURAL STEREOGRAMS

579

GEOLOGICAL REPORT ON OIL AND GAS POSSIBILITIES OF THE ANTIGONISH AREA, BY D. J. MACNEIL, 1952. 24 PAGES; STRATIGRAPHIC CHARTS

580

CAPE BRETON MINERAL RESOURCES - A GEOLOGICAL APPRAISAL, BY R. P. CORMIER, B. J. KEATING, H. R. OLDALE, W. S. SHAW, 1969. 12 PAGES; STRATIGRAPHIC CHARTS

581

MCGINTY LAKE QUARTZ VEINS, BY L. M. CUMMING, 1977. 12 PAGES; 6 MAP(S) (GEOLOGICAL); CROSS SECTIONS

582

STREAM SEDIMENT AND LAKE SEDIMENT GEOCHEMICAL SURVEYS REPORT ON KEJIMKUJIK NATIONAL PARK, NOVA SCOTIA, BY C. F. GLEESON, 1973. 11 PAGES

583

STRATIGRAPHY OF THE HORTON GROUP IN PARTS OF NOVA SCOTIA, BY B. C. MURRAY, 1960. 128 PAGES; 13 MAP(S) (GEOLOGICAL; PALEOGEOGRAPHIC; STUDY AREA LOCATION); COMPOSITE SECTIONS; CORRELATION DIAGRAMS; LITHOLOGICAL RECORDS; PHOTOGRAPHS; STRATIGRAPHIC COLUMNS

584

COAL RESOURCE POTENTIAL OF THE PORT MORIEN AREA, CAPE BRETON COUNTY, NOVA SCOTIA, BY D. J. MACNEIL, 1984. 7 PAGES; 2 MAP(S) (COAL SEAM LOCATION; CROSS SECTION LOCATION; DRILL HOLE LOCATION; GEOLOGICAL); CROSS SECTIONS; STRATIGRAPHIC COLUMNS

585

SUMMARY OF THE CARIBOU GOLD DISTRICT, BY P. K. SMITH, 1984. 45 PAGES; 5 MAP(S) (METALLIC MINERAL LOCATION; STUDY AREA LOCATION); CROSS SECTIONS; PHOTOGRAPHS

586

PRELIMINARY DRAFT REPORT ON THE RADON GAS PROJECT, BY H. LEBLANC, 1978. 10 PAGES; 4 MAP(S) (WELL WATER SAMPLE LOCATION); FREQUENCY DISTRIBUTION GRAPHS

587

RECOVERY OF GOLD FROM LAKE CHARLOTTE TAILINGS, NOVA SCOTIA, BY M. A. CRISTOVICI, G. W. LEIGH, 1982. 71 PAGES; PHOTOMICROGRAPHS (CANMET DIVISION REPORT MRP/MSL 82-94 (IR))

588

BARYTES, THE NO WEIGHT AGENT, BY J. H. FOWLER, 1984. 25 PAGES; 1 MAP(S) (MINE SURFACE PLANS); MINING PRODUCTION GRAPHS

589

TIN PRODUCTION - THE TIP OF THE ICEBERG IN SOUTHWESTERN NOVA SCOTIA, BY P. S. GILES, A. K. CHATTERJEE, 1984. 16 PAGES; CROSS SECTIONS; VARIATION DIAGRAMS

590

REPORT ON SUBSIDENCE OF THE RAIL TRACK ALONG THE AVON RIVER SECTION OF THE DOMINION ATLANTIC RAILWAY, BY G. M. HUTT, 1945. 13 PAGES; PHOTOGRAPHS

591

CHEMICAL ANALYSES OF MAFIC SILLS IN THE BEAR RIVER, WOLFVILLE-KENTVILLE AND NICTAUX-TORBROOK AREAS OF NOVA SCOTIA, BY S. M. BARR, E. M. DOYLE, L. S. TRAPASSO, 1983. 8 PAGES; 3 MAP(S) (ROCK SAMPLE LOCATION)

592

DEPTH ESTIMATES: VICTORIA JUNCTION MAGNETIC AND GRAVITY ANOMALIES, CAPE BRETON ISLAND, BY NOVA SCOTIA RESEARCH FOUNDATION, 1984. 15 PAGES; 2 MAP(S) (MAGNETIC, AIRBORNE; STUDY AREA LOCATION); GRAVITY PROFILES; MAGNETIC PROFILES

593

THE SURFICIAL GEOLOGY WITHIN THE IHD WATERSHED AT FRASER BROOK, COLCHESTER COUNTY, NOVA SCOTIA, BY T. W. HENNIGAR, 1966. 7 PAGES

594

HYDROGEOLOGY OF THE KELLEY RIVER IHD BENCHMARK BASIN, CUMBERLAND COUNTY, NOVA SCOTIA, BY T. W. HENNIGAR, 1974. 22 PAGES; 2 MAP(S) (HYDROGEOLOGICAL; PHYSIOGRAPHIC; STUDY AREA LOCATION; SURFICIAL GEOLOGICAL; WELL WATER LOCATION); CROSS SECTIONS; HISTOGRAMS; HYDROGRAPHS; PHOTOGRAPHS; STRATIGRAPHIC COLUMNS

595

GROUNDWATER SURVEY, BROOKFIELD AREA, COLCHESTER COUNTY, NOVA SCOTIA, BY T. W. HENNIGAR, 1968. 24 PAGES; 4 MAP(S) (DRILL HOLE LOCATION; STRUCTURAL CONTOUR; WELL WATER LOCATION); DRILL HOLE SECTIONS

596

SUMMARY REPORT ON THE FIFTEEN MILE STREAM GOLD DISTRICT, BY I. J. MACEACHERN, 1984. 14 PAGES; 4 MAP(S) (MINE LEVEL PLANS; STUDY AREA LOCATION)

598

PRELIMINARY REPORT - HANTS COUNTY PEAT DEPOSITS, BY W. A. BROUGHM, A. R. ANDERSON, 1984. 40 PAGES; 19 MAP(S) (PEAT DEPOSIT LOCATION; PEAT ISOPACH; STUDY AREA LOCATION; TOPOGRAPHIC; VEGETATION TYPE)

599

METALLIC MINERAL OCCURRENCES MAP AND DATA COMPILATION, CENTRAL NOVA SCOTIA - MAP SHEETS 11D AND 11E, BY M. PONSFORD, N. A. LYTTLE, 1984. 21 PAGES; 2 MAP(S) (GEOLOGICAL; METALLIC MINERAL LOCATION; NTS DIVISIONS)

600

METALLIC MINERAL OCCURRENCES MAP AND DATA COMPILATION, EASTERN NOVA SCOTIA - MAP SHEETS 11F, 11G, 11J, 11K, 11N, BY M. PONSFORD, N. A. LYTTLE, 1984. 23 PAGES; 2 MAP(S) (GEOLOGICAL; METALLIC MINERAL LOCATION; NTS DIVISIONS)

601

METALLIC MINERAL OCCURRENCES MAP AND DATA COMPILATION, WESTERN NOVA SCOTIA - MAP SHEETS 20O, 20P, 21A, 21B, 21H, BY M. PONSFORD, N. A. LYTTLE, 1984. 21 PAGES; 2 MAP(S) (GEOLOGICAL; METALLIC MINERAL LOCATION; NTS DIVISIONS)

602

NOVA SCOTIA GOLD MINING, BY J. HARTLEN, 1981. 15 PAGES

603

PRELIMINARY FEASIBILITY STUDY FOR AN UNDERGROUND GOLD MINING OPERATION IN CENTRAL NOVA SCOTIA, BY NOVA SCOTIA DEPARTMENT OF MINES+ENERGY, 1984. 62 PAGES; 1 MAP(S) (STUDY AREA LOCATION); ISOMETRIC PROJECTION DIAGRAMS; MINE CROSS SECTIONS; MINING PRODUCTION GRAPHS; PIE DIAGRAMS

Note: Open File Report 571 is confidential, and Open File Reports 577 and 597 are in preparation.

APPENDIX III

OPEN FILE MAPS FOR 1984

OPEN FILE MAPS FOR 1984

84-01

PRELIMINARY GEOLOGICAL MAP OF THE CUMBERLAND COAL BASIN (1:250,000), BY J. H. CALDER, 1984; 1 MAP(S) (GEOLOGICAL)

84-03

PLANIMETRIC MAP OF THE COUNTRY HARBOUR HEAD AREA, WITH INDEX TO GEOLOGICAL PLAN MAPS - 11F/04A (1:500), BY B. H. O'BRIEN, 1983; 1 MAP(S) (GEOLOGICAL INDEX MAP)

84-04

GEOLOGICAL MAP OF THE 0+00 FT.- 170 FT. PLAN INTERVAL, COUNTRY HARBOUR HEAD (1:60), BY B. D. WENTZELL, B. H. O'BRIEN, 1983; 1 MAP(S) (GEOLOGICAL; ROCK SAMPLE LOCATION)

84-05

GEOLOGICAL MAP OF THE 410 FT. - 460 FT. PLAN INTERVAL, COUNTRY HARBOUR HEAD (1:60), BY B. D. WENTZELL, B. H. O'BRIEN, 1983; 1 MAP(S) (GEOLOGICAL; ROCK SAMPLE LOCATION)

84-06

GEOLOGICAL MAP OF THE 560 FT. - 620 FT. PLAN INTERVAL, COUNTRY HARBOUR HEAD (1:60), BY B. H. O'BRIEN, 1983; 1 MAP(S) (GEOLOGICAL; ROCK SAMPLE LOCATION)

84-07

STREAM SEDIMENT GEOCHEMISTRY OF THE SYDNEY MAP SHEET - 11K/01 (1:50,000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 981)

84-08

STREAM SEDIMENT GEOCHEMISTRY OF THE FRAMBOISE MAP SHEET - 11F/09 (1:50,000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 982)

84-09

STREAM SEDIMENT GEOCHEMISTRY OF THE ST. PETER'S MAP SHEET - 11F/10 (1:50,000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 983)

84-10

STREAM SEDIMENT GEOCHEMISTRY OF THE CAPE NORTH MAP SHEET - 11N/01 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 984)

84-11

STREAM SEDIMENT GEOCHEMISTRY OF THE CAPE ST. LAWERENCE MAP SHEET - 11N/02 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 985)

84-12

STREAM SEDIMENT GEOCHEMISTRY OF THE PLEASANT BAY MAP SHEET - 11K/15 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 986)

84-13

STREAM SEDIMENT GEOCHEMISTRY OF THE DINGWALL MAP SHEET - 11K/16 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 987)

84-14

STREAM SEDIMENT GEOCHEMISTRY OF THE LOCHABER MAP SHEET - 11E/08 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 988)

84-15

STREAM SEDIMENT GEOCHEMISTRY OF THE GUYSBOROUGH MAP SHEET - 11F/05 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 989)

84-16

STREAM SEDIMENT GEOCHEMISTRY OF THE CHEDABUCTO BAY MAP SHEET - 11F/06 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 990)

84-17

STREAM SEDIMENT GEOCHEMISTRY OF THE PORT HAWKESBURY MAP SHEET - 11F/11 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 991)

84-18

STREAM SEDIMENT GEOCHEMISTRY OF THE ANTIGONISH MAP SHEET - 11F/12 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 992)

84-19

STREAM SEDIMENT GEOCHEMISTRY OF THE ST. ANNS HARBOUR MAP SHEET - 11K/07 (1:50 000), BY P. J. ROGERS, M. A. MACDONALD, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 993)

84-20

STREAM SEDIMENT GEOCHEMISTRY OF THE BRAS D'OR MAP SHEET - 11K/08 (1:50 000), BY M. A. MACDONALD, P. J. ROGERS, 1984; 13 MAP(S) (STREAM SEDIMENT GEOCHEMICAL; STREAM SEDIMENT SAMPLE LOCATION); HISTOGRAMS (GEOLOGICAL SURVEY OF CANADA, OPEN FILE 994)

84-21

GOLD VALUES IN QUARTZ VEINS OF THE COUNTRY HARBOUR HEAD AREA, GUYSBOROUGH COUNTY, NOVA SCOTIA - 11F/04A (1:500), BY B. H. O'BRIEN, 1984; 1 MAP(S) (ROCK GEOCHEMICAL)

Note: Open File Map 84-02 is in preparation.

APPENDIX IV

NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY

PUBLICATIONS FOR SALE

NOVA SCOTIA DEPARTMENT OF MINES AND ENERGY

PUBLICATIONS AND MAPS FOR SALE

PAPERS

Paper 76-1	Structural Model for the Saddle Reef and Associated Veins in the Meguma Group, Nova Scotia, by J. D. Keppie, 34 pages & 2 maps.	$3.00
Paper 76-2	Geological Data Collection in the Nova Scotia Department of Mines, by J. D. Keppie and A. K. Chatterjee, 15 pages.	$0.50
Paper 76-3	Interpretation of P.P.I. Radar Imagery of Nova Scotia, by J. D. Keppie, 31 pages & map.	$1.25
Paper 76-4	Geology, Geochemistry and Mineral Occurrences of the Northeast Margaree River Drainage Basin in parts of Inverness and Victoria Counties, Cape Breton, Nova Scotia, by B. E. MacNabb, J. H. Fowler and T. G. N. Covert, 30 pages & 12 maps.	$15.00
Paper 76-5	Guide to the Invertebrate Fauna of the Windsor Group in Atlantic Canada, by R. G. Moore and R. J. Ryan, 57 pages.	$2.25
Paper 77-1	Tectonics of Southern Nova Scotia, by J. D. Keppie, 34 pages (Reprinted 1980).	$3.00
Paper 77-3	Plate Tectonic Interpretation of Paleozoic World Maps (with Emphasis on Circum-Atlantic Orogens and Southern Nova Scotia), by J. D. Keppie, 45 pages (Reprinted 1982). (Microfiche $1.50)	$4.00
Paper 77-6	Sand and Gravel Resources of Pictou County, by J. H. Fowler and G. B. Dickie, 42 pages & map.	$4.00
Paper 77-7	Tungsten Mineralization in the Carbonate Rocks of the George River Group, Cape Breton Island, Nova Scotia, by A. K. Chatterjee, 26 pages.	$3.50
Paper 78-1	Geology of the Ecum Secum Area, Halifax and Guysborough Counties, Nova Scotia, by D. McBride, 12 pages.	$1.00
Paper 78-2	Age of Igneous Rocks along the Lennox Passage - St. Peter's Lineament, Southern Cape Breton Island, by J. D. Keppie and P. K. Smith, 10 pages.	$1.00
Paper 78-3	Geology of the Giant Lake Area, Southeastern Cape Breton Island, Nova Scotia, by P. K. Smith, 30 pages & map.	$2.00
Paper 78-4	Some Middle Devonian to Lower Carboniferous Rocks of Cape George, Nova Scotia, by J. D. Keppie, P. S. Giles, and R. C. Boehner, 37 pages.	$2.00
Paper 78-5	Petrology of the Early Silurian Dunn Point and McGillivray Brook Formations, Arisaig, Nova Scotia, by J. D. Keppie, J. Dostal and M. Zentilli, 20 pages.	$1.00

NSDME Report 85-1

Paper 79-1	Petrology of the Late Precambrian Fourchu Group in the Louisbourg Area, Cape Breton Island, by J. D. Keppie, J. Dostal and J. B. Murphy, 18 pages.	$1.50
Paper 79-2	Opencast Coal Reserves at Springhill, by B. Ward, 40 pages & 4 maps.	$4.50
Paper 79-3	Geology of the Meat Cove Zinc Deposit, Cape Breton Island, by A. K. Chatterjee, 27 pages.	$2.00
Paper 79-4	Minor and Trace Element Variations in Wisconsinan Tills, Eastern Shore Region, Nova Scotia, by R. R. Stea and J. H. Fowler, 30 pages & 3 maps.	$10.00
Paper 79-5	Pleistocene Stratigraphy of the Miller Creek Section, Hants County, Nova Scotia, by R. Stea and D. Hemsworth, 16 pages.	$3.00
Paper 79-6	Effects of Subsidence and Depositional Environment on the Formation of Lithotypes in a Hypautochthonous Coal of the Pictou Coalfield, by J. H. Calder, 23 pages.	$3.00
Paper 79-7	Carbonate Banks of the Gays River Formation in Central Nova Scotia, by P. S. Giles, R. C. Boehner and R. J. Ryan, 57 pages & map.	$4.00
Paper 80-1	Geology of the Cape North Area, Northern Cape Breton Island, Nova Scotia, by A. S. Macdonald and P. K. Smith, 60 pages & 2 maps. (Microfiche $2.00)	$5.00
Paper 81-1	The Pisset Brook Formation at Lowland Cove, Inverness County, Nova Scotia, by P. K. Smith and A. S. Macdonald, 18 pages. (Microfiche $1.00)	$2.00
Paper 81-2	Major Transgressive-Regressive Cycles in Middle to Late Visean Rocks of Nova Scotia, by P. S. Giles, 27 pages. (Microfiche $1.50)	$2.00
Paper 81-3	The Windsor Group of the Mahone Bay Area, Nova Scotia, by P. S. Giles, 51 pages, figure in back pocket. (Microfiche $1.50)	$4.00
Paper 81-4	Principles of Tectonic Mapping Based upon Plate Tectonic Theory, by J. D. Keppie, 11 pages. (Microfiche $1.00)	$1.50
Paper 82-1	Geology and Geochemistry of Selected Granitoid Plutons of Cape Breton Island, by S. M. Barr, G. A. O'Reilly and A. M. O'Beirne, 176 pages, 44 figs., 13 tables. (Microfiche $2.00)	$8.00
Paper 82-2	Metasomatic-Hydrothermal Mineral Deposits of the New Ross-Mahone Bay Area, Nova Scotia, by G. A. O'Reilly, E. J. Farley and M. H. Charest, 96 pages. (Microfiche $1.50)	$5.00

REPORTS

Report 75-1	Report of Activities of the Mineral Resources and Geological Services Division, 1974, by Nova Scotia Department of Mines, 75 pages.	$1.00
Report 76-1	Drilling Logs of Government Core Drills, 1974, by I. MacDougall and D. W. Grimm, 73 pages.	$1.00
Report 76-2	Mineral Resources Division, Report of Activities, 1975, 145 pages.	$3.00
Report 76-3	Drilling Logs of Government Core Drills, 1975, by I. MacDougall and D. W. Grimm, 47 pages.	$1.00
Report 77-1	Mineral Resources Division, Report of Activities, 1976, 207 pages.	$10.00
Report 77-2	Superseded by Report 81-4.	
Report 77-3	Drilling Logs of Government Core Drills, 1976, by I. MacDougall and D. W. Grimm, 33 pages.	$1.00
Report 78-1	Mineral Resources Division, Report of Activities, 1977, 104 pages.	$4.00
Report 78-2	Drilling Logs of Government Core Drills, 1977, by I. MacDougall and D. E. Polley, 72 pages.	$2.00
Report 78-3	Superseded by Report 81-6	
Report 78-4	Compilation of Isotopic Age Data of Nova Scotia, by J. D. Keppie and P. K. Smith, 54 pages & 7 maps.	$7.00
Report 79-1	Mineral Resources Division, Report of Activities, 1978, 177 pages.	$6.00
Report 79-2	Drilling Logs of Government Core Drills, 1978, by I. MacDougall and D. E. Polley, 54 pages.	$2.00
Report 80-1	Mineral Resources Division, Report of Activities, 1979, 248 pages.	$7.00
Report 80-2	Index to Drilling Logs of Government Core Drills, 1972-78, by N. A. Lyttle and J. Gillespie-Wood, 47 pages.	$3.00
Report 80-3	Drilling Logs of Government Core Drills, 1979, by I. MacDougall and D. E. Polley, 68 pages. (Microfiche $1.50)	$3.50
Report 81-1	Mineral Resources Division, Report of Activities, 1980, 199 pages. (Microfiche $2.00)	$8.00
Report 81-2	Compilation of Igneous Chemical Analyses from Nova Scotia, up to 1978, compiled by J. D. Keppie, P. K. Smith and M. A. K. Grice, 114 pages. (Microfiche $2.00)	$4.00
Report 81-3	Drilling Logs of Government Core Drills, 1980, by I. MacDougall and D. E. Polley, 52 pages. (Microfiche $1.00)	$3.50
Report 81-4	Index to Assessment Reports 1864-1980, by N. A. Lyttle and J. Gillespie-Wood, 109 pages. (Microfiche $3.00)	$10.00
Report 81-5	Keyword Index to Assessment Reports, 1864-1980, by N. A. Lyttle and J. Gillespie-Wood. (Microfiche only $5.00)	

Report 81-6	Index to Publications, Open File Reports and Theses, 1862-1980, by N. A. Lyttle and J. Gillespie-Wood, 222 pages. (Microfiche $3.00)	$10.00
Report 81-7	Index to Drillhole and Well Data, 1862-1980, by N. A. Lyttle and J. Gillespie-Wood, 127 pages. (Microfiche $3.00)	$10.00
Report 82-1	Mineral Resources Division, Report of Activities, 1981, 139 pages. (Microfiche $2.00)	$7.00
Report 82-2	Index to Assessment Reports, 1981 (with Keyword Index), by N. A. Lyttle and J. Gillespie-Wood, 11 pages. (Microfiche $2.00)	$3.00
Report 82-3	Keyword Index to Publications in NSDME Report 81-6, by N. A. Lyttle and J. Gillespie-Wood. (Microfiche only $2.00)	
Report 82-4	Keyword Index to Open File Reports in NSDME Report 81-6, by N. A. Lyttle and J. Gillespie-Wood. (Microfiche only $1.00)	
Report 82-5	Keyword Index to GSC Documents on Nova Scotia to 1980. (Microfiche only $2.00)	
Report 82-6	Drilling Logs of Government Core Drills, 1981, compiled by I. MacDougall and D. E. Polley, 1982, 60 pages. (Microfiche $1.50)	$3.50
Report 82-7	Uranium in Nova Scotia: A Background Summary for the Uranium Inquiry, Nova Scotia, 122 pages & 2 maps. (Microfiche only $2.00)	
Report 83-1	Mines and Minerals Branch, Report of Activities, 1982, 404 pages. (Microfiche $3.50)	$10.00
Report 83-2	Index to Assessment Reports 1982 (with Keyword Index), by N. A. Lyttle and J. Gillespie-Wood, 32 pages. (Microfiche $2.00)	$3.00
Report 83-3	Drilling Logs of Government Core Drills, 1982, compiled by I. MacDougall and D. E. Polley, 1983, 38 pages. (Microfiche $2.00)	$3.50
Report 84-1	Mines and Minerals Branch, Report of Activities, 1983, 352 pages. (Microfiche $4.00)	$10.00
Report 84-2	Index to Assessment Reports 1983 (with Keyword Index), by N. A. Lyttle and J. Gillespie-Wood, 88 pages. (Microfiche $2.00)	$8.50
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Report 84-4	Keyword Index to Theses in Report 81-6, Index to Publications, Open File Reports and Theses 1862-1980, by D. B. Hopper, J. Gillespie-Wood and N. A. Lyttle. (Microfiche only $5.00)	
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Report 84-6	Bibliography of the Surficial Geology of Nova Scotia and the Offshore (with Radiocarbon Date List), by R. R. Stea and V. J. Brisco. 128 p. (Microfiche $2.00) (Microfiche $4.00)	$6.00

MEMOIRS

Memoir 4	The Older Paleozoic of Pictou County, Nova Scotia, by R. H. Maehl, 1961, 109 pages & appendix & map.	$3.00
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Memoir 7	The Geology of the George River Series, Cape Breton, by G. C. Milligan, 1970, 111 pages & 7 maps.	$4.50

BULLETINS

Bulletin 1	Port Hawkesbury Project - Geology, Geochemistry and Groundwater Investigations of Southwest Inverness and Richmond Counties, Nova Scotia, by F. S. Shea and J. D. Wallace, 1962, 73 pages & 5 maps.	$2.00
Bulletin 2 (Part 1)	Limestones and Dolomites of Nova Scotia, Part I- Cape Breton Island, by F. S. Shea and D. A. Murray, 1969, 300 pages & map.	$4.00
Bulletin 2 (Part 2)	Limestones and Dolomites of Nova Scotia, Part II- Antigonish, Guysborough, Pictou, and Cumberland Counties, by D. A. Murray, 1975, 155 pages.	$6.50
Bulletin 3	Assessment of Peat Moss Occurrences in Guysborough, Antigonish, Pictou, Colchester and Cumberland Counties, Nova Scotia, by D. R. Sutherland and F. S. Shea, 1976, 301 pages.	$7.00
Bulletin 4	Barite, Celestite and Fluorite in Nova Scotia, by G. W. Pelderhof, 1978, 463 pages, 200 figures, 12 tables.	$13.00

INFORMATION SERIES

No. 1	Geology, Minerals and Mining in Nova Scotia, by J. M. Richardson and D. J. Gregory, 1976, 22 pages.	Free
No. 2	A History of Coal Mining in Nova Scotia, compiled by D. J. Gregory, 1978, 41 pages.	Free

No. 3	Program and Summaries, Fourth Annual Open House and Review of Activities of the Mineral Resources Division, by Nova Scotia Department of Mines and Energy, 1980, 106 pages. (Microfiche only $1.00)	
No. 4	Program and Summaries, Fifth Annual Open House and Review of Activities, by Nova Scotia Department of Mines and Energy, 1981, 51 pages. (Microfiche only $1.00)	
No. 5	Program and Summaries, Sixth Annual Open House and Review of Activities, by Nova Scotia Department of Mines and Energy, 1982, 69 pages. (Microfiche $1.00)	$1.00
No. 6	Program and Summaries, Seventh Annual Open House and Review of Activities, by Nova Scotia Department of Mines and Energy, 1983, 123 pages. (Microfiche only $2.00)	
No. 7	Program and Summaries, Eigth Annual Open House and Review of Activities, by Nova Scotia Department of Mines and Energy, 1984, 115 pages. (Microfiche $1.00)	$2.00

REPRINT SERIES

No. 1	Paleozoic Volcanic Rocks of Nova Scotia, by J. D. Keppie and J. Dostal, 1980, 8 pages. Reprinted from - Proceedings: "The Caledonides in the U.S.A." I.G.C.P. Project 27: Caledonide Orogen.	$1.00
No. 2	Granitoid and Other Plutonic Rocks of Nova Scotia, by D. B. Clarke, S. M. Barr and H. V. Donohoe, 1980, 10 pages. Reprinted from - Proceedings: "The Caledonides in the U.S.A." I.G.C.P. Project 27: Caledonide Orogen.	$1.00
Reprint 81-1	Determination of Gold in Natural Waters at the Parts-per-Trillion (pg cm^{-3}) level, by R. R. Brooks, A. K. Chatterjee and D. E. Ryan, 7 pages. Reprinted from Chemical Geology, 33, 1981. (Microfiche only $1.00)	
Reprint 82-1	Observations on the Ichnology of the Meguma Group (?Cambro-Ordovician) of Nova Scotia, by R. K. Pickerill and J. D. Keppie, 1981, 9 pages. Reprinted from Maritime Sediments and Atlantic Geology, 17, 1981. (Microfiche $1.00)	$1.50
Reprint 82-2	A Rapid Method for the Determination of Gold and Silver in Sulfide Ores and Rocks, by R. R. Brooks, J. Holzbecher, D. E. Ryan, H. P. Zhang and A. K. Chatterjee, 1981, 4 pages. Reprinted from Atomic Spectroscopy, v.2, No. 5, 1981. (Microfiche only $1.00)	

Reprint 82-3	Geochemistry and the Distribution of Uranium and Thorium in the Granitoid Rocks of the South Mountain Batholith, Nova Scotia, by A. K. Chatterjee and G. K. Muecke, 17 pages. Reprinted from Uranium in Granites: Geological Survey of Canada, Paper 81-23, p. 11-17, 1982. (Microfiche $1.00)	$1.50
Reprint 82-4	The Minas Geofracture, by J. D. Keppie, 1982. Reprinted from Geological Association of Canada, Special Paper 24, 18 pages. (Microfiche $1.00)	$2.00
Reprint 82-5	The Distribution of Gold in Rocks and Minerals of the Meguma Group of Nova Scotia, Canada, by R. R. Brooks, A. K. Chatterjee, P. K. Smith, D. E. Ryan and H. F. Zhang, 9 pages. Reprinted from Chemical Geology, v. 35, 1982. (Microfiche only $1.00)	
Reprint 83-1	A Multivariate Approach to Geochemical Distinction Between Tin-specialized and Uranium-specialized Granites of Southern Nova Scotia, by A. K. Chatterjee, D. F. Strong, and G. K. Muecke. Reprinted from Canadian Journal of Earth Sciences, 20, 1983. (Microfiche $1.00)	$1.50
Reprint 83-2	Uranium and Thorium in Paleozoic Rhyolites of Nova Scotia, by J. Dostal, C. Dupuy, and J. D. Keppie. Reprinted from Canadian Journal of Earth Sciences, 20, No. 2, 1983. (Microfiche $1.00)	$1.50
Reprint 84-1	Proceedings of the Deformation Study Group, Caledonide Orogen Project, by J. D. Keppie, D. G. Gee, D. Roberts, D. Powell, M. D. Max, P. Osberg, A. Pique, and J. P. Lecorche. Reprinted from Regional Trends in the Geology of the Appalachian-Caledonian-Hercynian-Mauritanide Orogen, edited by P. E. Schenk, 1983, p. 275-278.	$1.50
Reprint 84-2	Times of Deformation in the Canadian Appalachians, by J. D. Keppie, P. St. Julien, C. Hubert, J. Beland, B. Skidmore, L. R. Fyffe, A. A. Ruitenberg, S. R. McCutcheon, H. Williams and J. Bursnall. Reprinted from Regional Trends in the Geology of the Appalachian-Caledonian-Hercynian-Mauritanide Orogen, edited by P. E. Schenk, 1983, p. 307-313.	$1.50
Reprint 84-3	Petrology and Geochemistry of Devono-Carboniferous Volcanic Rocks in Nova Scotia, by J. Dostal, J. D. Keppie and C. Dupuy. Reprinted from Maritime Sediments and Atlantic Geology, 19, 1983, p. 59-71.	$1.50
Reprint 84-5	Mining in Nova Scotia-Past and Present, by Howard V. Donohoe, Jr. Reprinted from CIM Directory 1984, p. 1-24. (Microfiche $1.00)	$1.50

Reprint 84-6	Discriminant and Factor Analysis of Geochemical Data from Granitoid Rocks Hosting the Millet Brook Uranium Mineralization, South Mountain Batholith, Nova Scotia, by A. K. Chatterjee and D. F. Strong. Reprinted from Uranium, 1, 1984, p. 289-305.	$3.00

ECONOMIC GEOLOGY SERIES

EGS74-1	Geology and Trace Elements of Nova Scotia Manganese Occurrences in Nova Scotia, by D. G. Bishop and J. D. Wright, 1974, 255 pages.	$7.50
EGS75-1	Iron Deposits of Nova Scotia, by J. D. Wright, 1975, 154 pages & map.	$6.00

MISCELLANEOUS PUBLICATIONS

Core Drilling in Nova Scotia with Government Drills, 1871-1966, 176 pages.	$2.00
Core Drilling in Nova Scotia with Government Drills, 1967-1971, 49 pages.	$1.00
Drilling Logs of Government Core Drills, 1958-1973. (Logs are in Mines Reports prior to 1958; logs are published as NSDME Reports after 1973). (Logs for individual years cost $1.00 each)	$16.00
Possibilities for Occurrence of Petroleum Reservoirs in Nova Scotia, by W. A. Bell, 1958, 177 pages.	$1.00
Metallic Mineral Occurrences Recorded in the Province of Nova Scotia, by Nova Scotia Department of Mines, 1966, 350 pages.	$4.00
Handbook for Companies Planning Offshore Drilling, by Nova Scotia Department of Mines, 1969, 23 pages.	$0.50
Clay and Sand Deposit at Elmsvale, Halifax County, Nova Scotia, by J. H. Fowler, 1972, 62 pages & drillhole sections.	$2.50
Geology of the Middle River and Baddeck Forks Map Areas, Victoria County, Nova Scotia, by B. E. Jones and T. G. N. Covert, 1972, 124 pages & 5 maps.	$5.00
Petroleum Exploration in Nova Scotia, by W. Potter and T. Dexter, 1974, 15 pages.	$1.00
Bibliography of the Geology of Nova Scotia, by D. J. Gregory, 1975, 237 pages. (Microfiche only $4.00)	
Oil and Gas Exploration in Nova Scotia, 1982-83, by Nova Scotia Department of Mines and Energy, 1983.	$2.00
Nova Scotia: Oil and Gas Report 1984.	$2.00

ACTS

Mineral Resources Act, by Nova Scotia Department of Mines and Energy, 1975, 61 pages.	$1.50
Regulations under the Mineral Resources Act, 1975,	
-Work on Mineral Rights, 4 pages.	$0.25
-Boundaries of Mineral Lands, 4 pages.	$0.25
-Schedule of Fees, 1 page.	$0.25
-Royalities, 1 page.	$0.25

Metalliferous Mines & Quarries Regulation Act, by Nova Scotia Department of Mines and Energy, 1967, 83 pages. $3.00

Coal Mines Regulation Act, by Nova Scotia Department of Mines and Energy, 1967, 143 pages. $3.00

Petroleum Resources Act, by Nova Scotia Department of Mines and Energy, 1984. (Photocopy available while in press)

Gypsum Mining Income Tax Act, by Nova Scotia Department of Mines and Energy, 1954, 13 pages. $1.00

An Act Respecting Exploration for the Underground Storage of Gas, by Nova Scotia Department of Mines and Energy, 1970, 6 pages. $1.00

MAPS

Preliminary Map 78-1 Geology Map of the Cobequid Highlands, by H. V. Donohoe and P. I. Wallace, scale 1:125,000. $3.50

Map 81-1 Pleistocene Geology and Till Geochemistry, Central Nova Scotia, (Sheet 4; Sheets 1, 2 and 3 are in Paper 79-4), by R. R. Stea and J. H. Fowler, scale 1:100,000. $3.50

Map 82-1 Pleistocene Geology and Till Geochemistry of South Central Nova Scotia (Sheet 6), by R. R. Stea, scale 1:100,000. $3.50

Map 82-2 Antigonish Basin, by R. C. Boehner and P. S. Giles, scale 1:50,000. $3.00

Map 82-3 Eureka Area, by P. S. Giles, scale 1:50,000. $3.00

Map 82-4 Shubenacadie and Musquodoboit Basins, by P. S. Giles and R. C. Boehner, scale 1:50,000. $5.00

Map 82-5 Geology Map of the Northern Antigonish Highlands, Nova Scotia, by J. B. Murphy, J. D. Keppie and A. Hynes, scale 1:50,000. $4.00

Map 82-6 Advocate Harbour-Port Granville Region, by H. V. Donohoe Jr. and P. I. Wallace, scale 1:50,000. $8.00

Map 82-7 Parrsboro-Five Islands Region, by H. V. Donohoe Jr. and P. I. Wallace, scale 1:50,000. $8.00

Map 82-8 Economy River-Folly Lake Region, by H. V. Donohoe Jr. and P. I. Wallace, scale 1:50,000. $8.00

Map 82-9 Debert-Mt. Thom Region, by H. V. Donohoe Jr. and P. I. Wallace, scale 1:50,000. $8.00

Note: Maps 82-6 to 82-9 may be purchased individually or as a set for $25.00.

Map 82-10 Pleistocene Geology and Till Geochemistry of Southwestern Nova Scotia (Sheets 7 + 8), by R. R. Stea and D. R. Grant, scale 1:100,000. $8.00

Map 83-1 Geological Map of the Hantsport Area, Nova Scotia, compilation and geology by S. A. Ferguson, scale 1:25,000. $5.00

Map 83-2 Calculated Vertical Magnetic Gradient Map of the Cape Breton Highlands, Inverness, and Victoria Counties, Nova Scotia, scale 1:125,000. $5.00

Map 83-3 Salt and Potash Resources of Nova Scotia, by R. C. Boehner, scale 1:500,000. $4.00

Map 83-4 Geological Map of the Red River Anorthosite Complex, Inverness and Victoria Counties, Nova Scotia, by P. K. Smith and A. S. Macdonald, scale 1:125,000. $1.50

Map 84-1	Geological Map of the Cochrane Hill Open-Pit Gold Deposit, Guysborough County, Nova Scotia, by P. K. Smith, scale 1:66.7.	$8.00
Geological Map of Nova Scotia, by J. D. Keppie, scale 1:500,000, 1979, with metamorphic and structural map inserts, by J. D. Keppie and G. K. Muecke, scale 1:1,000,000.		$2.50
Geological Map of Nova Scotia, Metallic Mineral Occurrence Edition, by J. D. Keppie, D. J. Gregory, A. K. Chatterjee and N. A. Lyttle, scale 1:500,000, 1979, with structural and metamorphic map inserts, by J. D. Keppie and G. K. Muecke, scale 1:1000,000.		$2.50
Geological Map of Nova Scotia, Bouguer Gravity Anomaly Edition, by J. D. Keppie, scale 1:500,000, 1979, with metamorphic and structural map inserts, by J. D. Keppie and G. K. Muecke, scale 1:1,000,000.		$2.50
Tectonic Map of Nova Scotia, by J. D. Keppie, scale 1:500,000, 1982.		$5.00
Metallogenic Map of Nova Scotia, by A. K. Chatterjee, scale 1:500,000, 1983.		$5.00
Folio of Geological Maps of Nova Scotia - Includes Geological, Structural, Metamorphic, Classes of Mineral Deposits, Bouguer Gravity Anomaly and Magnetic Maps, by J. D. Keppie, G. K. Muecke, A. K. Chatterjee and others, scale 1:2,000,000, 1979.		$1.00
A Map Book of the Province of Nova Scotia, Geological Edition, scale 1:250,000, 1979, 46 pages.		$10.00
Index of Map Book of Nova Scotia, 1979.		$1.00
Claims maps (compilation) of Nova Scotia, scale 1:500,000 (1 white print)		$5.00
Reservation Grid System for Petroleum Licenses, Onshore, scale 1:500,000 (1 white print).		$2.00
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